INSTALLATION RESTORATION PROGRAM (IRP)

PHASE II STAGE 2 INVESTIGATION

VOLUME II
APPENDICES A-F

127th FIGHTER WING
MICHIGAN AIR NATIONAL GUARD
SELFRIDGE AIR NATIONAL GUARD BASE
MT. CLEMENS, MICHIGAN

DECEMBER 1996

Prepared For

ANGRC/CEVR
ANDREWS AFB, MARYLAND

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
December 1996

3. REPORT TYPE AND DATES COVERED
Phase II Stage 2 Investigation

4. TITLE AND SUBTITLE
Installation Restoration Program Phase II Stage 2 Investigation, Vol. II
127th Fighter Wing
Selfridge ANGB, Mt. Clemens, Michigan

5. FUNDING NUMBERS
DAHA90-91-D-0002/13

6. AUTHOR(S)
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Operational Technologies Corporation
4100 N.W. Loop 410
Suite 230
San Antonio, Texas 78229-4253

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Air National Guard Readiness Center/CEVR
3500 Fetchet Avenue
Andrews AFB MD 20762-5157

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release;
distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

An investigation was performed on eight sites at Selfridge Air National Guard Base; Site 1 - Southwest Landfill, Site 2 - Fire Training Area 2, Site 3 - Fire Training Area 1, Site 4 - West Ramp, Site 5 - Tucker Creek Landfill, Site 6 - Northwest Landfill, Site 7 - East Ramp, and Site 8 - Base Coal Storage Pile. Volume II contains the following Appendices; A - Definitions, Acronyms, and Units of Measurement, B - Statement of Work, C - Clayton Environmental Consultants' Report, D - Professional Profiles of Key Weston Personnel, E - National Ambient Air Quality Standards, and F - Quality Assurance Project Plan.

14. SUBJECT TERMS
Installation Restoration Program; Air National Guard; Phase II Stage 2 Investigation Volume I, Selfridge Air National Guard Base, Mt. Clemens, Michigan

15. NUMBER OF PAGES
Approx. 600

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	none

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to ***stay within the lines*** to meet ***optical scanning requirements***.

Block 1. Agency Use Only *(Leave blank)*.

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

C -	Contract	**PR** -	Project
G -	Grant	**TA** -	Task
PE -	Program Element	**WU** -	Work Unit Accession No.

Block 6. Author(s). Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es). Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es). Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Report Number. *(If known)*

Block 11. Supplementary Notes. Enter information not included elsewhere such as: Prepared in cooperation with...; Trans. of...; To be published in.... When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12a. Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

- **DOD** - See DoDD 5230.24, "Distribution Statements on Technical Documents."
- **DOE** - See authorities.
- **NASA** - See Handbook NHB 2200.2.
- **NTIS** - Leave blank.

Block 12b. Distribution Code.

- **DOD** - Leave blank.
- **DOE** - Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.
- **NASA** - Leave blank.
- **NTIS** - Leave blank.

Block 13. Abstract. Include a brief *(Maximum 200 words)* factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phrases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price code *(NTIS only)*.

Blocks 17. - 19. Security Classifications. Self-explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification on the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

DEPARTMENT OF THE AIR FORCE
AIR NATIONAL GUARD READINESS CENTER

20 Mar 97

ANG/CEVR
3500 Fetchet Avenue
Andrews AFB MD 20762-5157

Defense Technical Information Center
ATTN: Crystal Riley
8725 John J. Kingman Rd Ste 0944
Fort Belvoir VA 22060-6218

Dear Ms. Riley

Reference your letter dated 4 March 97 and return of our reports due to poor copy quality. Unfortunately, these reports are the only copy available and are being returned to you with the request that they be scanned "as is".

Thank you for bringing this problem to our attention. We are taking steps to assure our contractor reports are more readable in the future.

If we can be of any further assistance, please contact TSgt Linda Caudle at DSN: 278-8207.

Gary L. Hinkle

GARY L. HINKLE
Chief, Installation Restoration
Program Branch
Environmental Division

Enclosures
Reports

INSTALLATION RESTORATION PROGRAM (IRP)

PHASE II STAGE 2 INVESTIGATION

VOLUME II
APPENDICES A-F

127th FIGHTER WING
MICHIGAN AIR NATIONAL GUARD
SELFRIDGE AIR NATIONAL GUARD BASE
MT. CLEMENS, MICHIGAN

DECEMBER 1996

Prepared For

ANGRC/CEVR
ANDREWS AFB, MARYLAND

Prepared By

Operational Technologies Corporation
4100 N.W. Loop 410, Suite 230
San Antonio, Texas 78229-4253
(210) 731-0000

INSTALLATION RESTORATION PROGRAM (IRP)

PHASE II STAGE 2 INVESTIGATION

VOLUME II
APPENDICES A-F

127th FIGHTER WING
MICHIGAN AIR NATIONAL GUARD
SELFRIDGE AIR NATIONAL GUARD BASE
MT. CLEMENS, MICHIGAN

DECEMBER 1996

Operational Technologies Corporation Prepared

- Executive Summary
- Summary and Conclusions

Roy F. Weston, Inc. Prepared

- Introduction
- Results and Significance of Findings
- Field Investigation Program
- Environmental Setting
- Preliminary Feasibility Study
- Appendices A through Q

WESTON

TABLE OF CONTENTS

APPENDIX A

DEFINITIONS, ACRONYMS, AND UNITS OF MEASUREMENTS

DEFINITIONS

Alluvium	A general term for all detrital deposits resulting from the operations of modern rivers, thus including the sediments laid down in river beds, floodplains, lakes, fans at the foot of mountain slopes, and estuaries.
Annular Space	The dimension between the well casing and screen and the borehole wall.
Aquifer	A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.
Aquiclude	A body of relatively impermeable rock that is capable of absorbing water slowly but functions as an upper or lower boundary of an aquifer and does not transmit groundwater rapidly enough to supply a well or spring.
Aquitard	A confining bed that retards but does not prevent the flow of water to or from an adjacent aquifer.
Artesian	Groundwater confined under hydrostatic pressure.
Casing	A steel, concrete or plastic pipe used to line or protect a well.
Coarse Grained	A descriptive term for particle size indicating a diameter of 0.5 to 1 mm.
Downgradient	In the direction of decreasing hydraulic static head; the direction in which groundwater flows.
Fat	A descriptive term describing sediment or soil that contains primarily cohesive sticky clay.
Fine Grained	A descriptive term for particle size indicating a diameter of 0.125 to 0.25 mm.
Friable	Easily crumbled, as would be the case with rock that is poorly cemented.

Glacial Drift	All rock material transported in glacier ice including all deposits formed by ice and glacial melt water.
Glacial Outwash	Sediments deposited by melt water streams beyond active glacial ice.
Glacial Till	Nonsorted, nonstratified sediment carried or deposited by a glacier.
Grout	A synonym for a cement and bentonite mixture, refers to pumping or otherwise placing a cement slurry between the casing and the borehole wall.
Hydraulic Gradient	Change in elevation of the water table or potentiometric surface with respect to distance, e.g., slope of the water table or potentiometric surface.
Loam	A soil composed of a mixture of clay, silt, sand and organic matter.
Overburden	Unconsolidated materials which overlie bedrock.
Permeability	The property or capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.
Potentiometric Surface	Surface to which water in an aquifer would rise by hydrostatic pressure. Also referred to as piezometric surface.
Riser	Solid steel or PVC casing which extends from the well screen or open section of the well to above the ground surface.
Screen	Perforated section of well production tubing which allows water to enter tubing without undue head loss.
Transmissivity	The rate at which water is transmitted through a unit width under a unit hydraulic gradient.
Water Table	That surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

ACRONYMS AND UNITS OF MEASUREMENT

ANGB	Air National Guard Base
ASTM	American Society for Testing and Materials
BLS	Below Land Surface
BNA	Base-neutral and acid-extractable organic compounds
CERCLA	Comprehensive Environmental, Response, Compensation and Liability Act of 1980
cm/s	Centimeters per second
COD	Chemical oxygen demand
DEQPPM	Defence Environmental Quality Program Policy Memorandum
DOD	Department of Defense
^oC	Degrees Centigrade
^oF	Degrees Fahrenheit
ft/min	Feet per minute
gpm	Gallons per minute
HARM	Hazard Assessment Rating Method
HNU	A type of photoionization detector for measurement of organic vapors
hr	Hour
in	Inches
IRP	Installation Restoration Program
LEL	Lower explosive limit
MS	Master of Science Degree
ug/kg	Micrograms per kilogram (parts per billion)
ug/l	Micrograms per liter (equivalent to parts per billion in liquids with specific gravity of 1.0 -- i.e., water)

umho/cm	Micromhos per centimeter (units of Specific Conductance)
mg/kg	Milligrams per kilogram (parts per million)
mg/l	Milligrams per liter (equivalent to parts per million in liquids with specific gravity of 1.0 -- i.e., water)
ml	Milligrams
MSL	Mean Sea Level Datum
N	North
No.	Number
OEHL	Occupational and Environmental Health Laboratory
OEHL/TS	Occupational and Environmental Health Laboratory/Technical Services
%	Percent
P.G.	Registered Professional Geologist
pH	Negative logarithm of hydrogen ion concentration; measurement of acid and bases
P. HG.	Registered Professional Hydrogeologist
Ph.D.	Doctor of Philosophy Degree
ppb	Parts per billion
ppm	Parts per million
QA/QC	Quality Assurance/Quality Control
RCRA	Resources Conservation and Recovery Act of 1976
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TVO	Total volatile organics
USAF	United States Air Force

USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound

APPENDIX B

STATEMENT OF WORK

1281

CONTRACTS, PURCHASE ORDERS, AGREEMENTS, AMENDMENTS

ROUTING SLIP

Date: 11-7-81 W.O. No. [illegible]

Project Manager: [illegible] Copy Sent

Project Director: [illegible]

CIRCULATION: [illegible]

Legal: WDH [illegible] Confidential Client

PM Contacted: SMD [illegible]

VP-QA/P AFT [illegible] Certificate of Insurance

Acknowledgment Required: No Date Sent

Comments:

RECEIVED

New Work: Amendment 1981

RFW 103-4-82 Contracts Management

REF DDX

55X

ORDER FOR SUPPLIES OR SERVICES

1. PAGE 1 OF 38

2. PROC INSTRUMENT ID NO. (PIIN): F33615-87-D-4018
Mark all packages & papers with this number.

3. CALL/ORDER NO.: 0002

4. DATE OF ORDER*: 87SEP25

5. REQUISITION/PURCHASE REQUEST PROJECT NO.: FY7624-87-01628

6. CERTIFIED FOR NATIONAL DEFENSE UNDER DO-C9
BDC REG 2/DMS REG 1 RATING

7. ISSUED BY CODE FQ8419
DEPARTMENT OF THE AIR FORCE
AIR FORCE SYSTEMS COMMAND
AERONAUTICAL SYSTEMS DIV/PMRSC
WRIGHT-PATTERSON AFB OH 45433-6503
CONTRACT NEGOTIATOR:
FREDERICK P. KIRCHNER
PHONE: (513)-255-5911

8. ADMINISTERED BY CODE S3915A
DCASMA PHILADELPHIA
P.O. BOX 7699
PHILADELPHIA PA 19101-7699

9. CONTRACTOR NAME AND ADDRESS CODE 2M222
ROY F. WESTON INCORPORATED
WESTON WAY
WEST CHESTER PA 19380

PHONE: (215)-692-3030
COUNTY: CHESTER

FACILITY CODE
IF "9" FOR MULTIPLE FACILITIES SEE SECT "G"

SEP 30 1987

10. MAIL INVOICES TO

11. DISCOUNT FOR PROMPT PAYMENT
1ST N % ___ DAYS
2ND ___ % ___ DAYS
3RD ___ % ___ DAYS
NET DAYS ___ OTHER IF "9" SEE SECT "B"

12A. PURCHASE OFFICE POINT OF CONTACT
LTQ/L05/LTQ

12B. RESERVED FOR SERVICE/AGENCY USE

13. PAYMENT WILL BE MADE BY CODE S3910A IF "9" SEE SECT "G"
DCASR PHILADELPHIA
P.O. BOX 7730
PHILADELPHIA PA 19101-7478

14. TYPE CONTRACTOR: A

15. SECURITY A. CLAS: U B. DATE OF DD 254:

16. CONTRACT ADMINISTRATION DATA
A. FAST PAY | B. CONTRACT (1) KIND 1 (2) TYPE Y | C. ABSTRACT RECIP ADP POINT | D. SPL CONT PROVISIONS | E. CONT ADMIN FUNC LMT

17. (RESERVED)

18. SVC/AGENCY USE

19. SURV CRIT: C

20. TOTAL AMOUNT: NOT-TO-EXCEED $ 952,315.00

21. APPROPRIATION AND ACCOUNTING DATA
A. SCTY CL: U B. ACRN: AA C. APPROPRIATION: 5773400 D. LIMIT SUBHEAD:
E. SUPPLEMENTAL ACCOUNTING CLASSIFICATION: 307 41F3 020700 070000 60500 000000 415300
F. CPN RECIPIENT DODAAC: F15300 G. OBLIGATION AMOUNT: 952,315.00 H. NON-CLIN/ELIN PAYMENT PROV: * I. SVC AGENCY USE: FY7624-87-01628

22A. TYPE OF ORDER
DELIVERY X
B. NON-DOD CONTRACT NO.
This delivery order is subject to instructions contained on this side of form only and is issued in accordance with and subject to terms and conditions of above numbered contract, or Non-DOD Contract No.

PURCHASE
Reference your ___
Furnish the following on terms specified herein, including, for U.S. purchases, General Provisions of Purchase Order on DD Form 1155 (EXCEPT CLAUSE NO. 13 APPLIES ONLY IF THIS BOX IS CHECKED AND NO. 15 IF THIS BOX IS CHECKED), special provisions ___ and delivery as indicated. This purchase is negotiated under authority of 10 USC 2304(a)( ) or as specified in the schedule if within the U.S., its possessions or Puerto Rico; if otherwise, under 2304(a)(6).
If checked, Additional General Provisions apply, supplier shall sign Acceptance on DD form 1155 and return ___ copies.

*If quantity accepted by the Government is same as quantity ordered, indicated by ✓ mark. If different enter actual quantity accepted below quantity ordered and encircle.

23. UNITED STATES OF AMERICA
JOHN M. LIPKER 87SEP29 (YYMMMDD)
BY: NAME OF CONTRACTING/ORDERING OFFICER AND DATE

24. TOTAL
28. DIFFERENCES

25. QUANTITY ORDERED HAS BEEN
☐ INSPECTED ☐ RECEIVED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS STATED

DATE SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

26. SHIP NO. ☐ PARTIAL ☐ FINAL
27. D.O. VOUCHER NO.
29. INITIALS
30. PAYMENT ☐ COMPLETE ☐ PARTIAL ☐ FINAL
31. PAID BY
32. Amount Verified Correct For
33. CHECK NUMBER
34. BILL OF LADING NO.

35. I CERTIFY THIS AMOUNT IS CORRECT AND PROPER FOR PAYMENT
SIGNATURE AND TITLE OF CERTIFYING OFFICER

36. RECEIVED AT | 37. RECEIVED BY | 38. DATE RECEIVED | 39. TOTAL CONTAINERS | 40. S/R ACCOUNT NUMBER | 41. S/R VOUCHER NO.

PREVIOUS EDITION IS OBSOLETE.

AFSC FORM 700 AUG 80
*When used as a formal contract this will be the effective date.
AFSC—Andrews AFB Md 1980

*AF FORM 616 #87-94, dtd 87 APR 23

PART I SECTION B OF THE SCHEDULE
SUPPLIES LINE ITEM DATA

1. PROC INSTRUMENT ID NO. (PIIN): F33615-87-D-4018
2. SPIIN: 0002
3. PAGE 2 OF 38

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
0001	1	LO	$ N	$ N

9. SCTY CLAS	10. ACRN	11. NSN	12. FSCM AND PART NUMBER	13. CIRR
U	AA	N		

14. SITE CODES: A.POA D B.ACP D C.FOB D
15. NOUN: SAMPLING, ANALYSIS AND DATA
16. SVC/AGENCY USE

17. PR/MIPR DATA: FY7624-87-01628
18. AUTHORIZED RATE A.PROGRESS PAY % B.RECOUP %
19. CONTRACT PERCENT FEE %
20. SVC ID NO.
21. ITEM/PROJ MGR: FY7624
22. 1ST DISCOUNT A. % B.DAYS
23. 2ND DISCOUNT A. % B.DAYS
24. 3RD DISCOUNT A. % B.DAYS
25. NET DAYS
26. QUANTITY VARIANCE A. OVER % B. UNDER %
27. TYPE CONTRACT
28. OPR

29. DESCRIPTIVE DATA

CONDUCT WORK IAW THE TASK DESCRIPTION OF THIS ORDER AND SECTION C, THE DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT. SUBMIT DATA IAW ATTACHMENT #1, THE CONTRACT DATA REQUIREMENTS LIST OF THE BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION.

THIS ORDER SUPERCEDES THE LETTER AUTHORIZATION DATED 87 SEP 25 AND DESIGNATED ORDER NO. F33615-87-D-4018/0002. ANY COSTS INCURRED OR PAYMENTS MADE UNDER THE PROVISIONS OF THE INSTRUMENT REFERENCED WILL BE CONSIDERED TO HAVE BEEN MADE UNDER THIS INSTRUMENT.

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
0002	1	LO	$ N	$ N

9. SCTY CLAS	10. ACRN	11. NSN	12. FSCM AND PART NUMBER	13. CIRR
U	AA	N		

14. SITE CODES: A.POA D B.ACP D C.FOB D
15. NOUN: SUPPORT
16. SVC/AGENCY USE

17. PR/MIPR DATA: FY7624-87-01628
18. AUTHORIZED RATE A.PROGRESS PAY % B.RECOUP %
19. CONTRACT PERCENT FEE %
20. SVC ID NO.
21. ITEM/PROJ MGR: FY7624
22. 1ST DISCOUNT A. % B.DAYS
23. 2ND DISCOUNT A. % B.DAYS
24. 3RD DISCOUNT A. % B.DAYS
25. NET DAYS
26. QUANTITY VARIANCE A. OVER % B. UNDER %
27. TYPE CONTRACT
28. OPR

29. DESCRIPTIVE DATA

PROVIDE SUPPORT IN ACCORDANCE WITH THE TASK DESCRIPTION OF THIS ORDER AND SECTION C, THE DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT.

*REPRESENTS NET AMOUNT OF INCREASE/DECREASE WHEN MODIFYING EXISTING ITEM NO.

N = NOT APPLICABLE
U = UNDEFINITIZED
NSP = NOT SEPARATELY PRICED
E = ESTIMATED
− (IN QTY AND $) = DECREASE
+ OR − (IN ITEM NO.) = ADDITION OR DELETION
CIRR: CONTROLLED ITEM RPT RQMT

SITE CODES: S = SOURCE, D = DESTINATION, O = INTERMEDIATE

REF 70E

70E

PART I SECTION B OF THE SCHEDULE
SUPPLIES LINE ITEM DATA

1. PROC INSTRUMENT ID NO. (PIIN): F33615-87-D-4018
2. SPIIN: 0002
3. PAGE 3 OF 38

4. ITEM NO.: 0003
5. QUANTITY*: 1
6. PURCH UNIT: LO
7. UNIT PRICE: $ N
8. TOTAL ITEM AMOUNT*: $ N
9. SCTY CLAS: U
10. ACRN: AA
11. NSN: N
12. FSCM AND PART NUMBER
13. CIRR
14. SITE CODES: A. PQA: D B. ACP: D C. FOB: D
15. NOUN: COMPUTER SOFTWARE
16. SVC/AGENCY USE
17. PR/MIPR DATA: FY7624-87-01628
18. AUTHORIZED RATE A. PROGRESS PAY % B. RECOUP %
19. CONTRACT PERCENT FEE %
20. SVC ID NO.
21. ITEM/PROJ MGR: FY7624
22. 1ST DISCOUNT A. % B. DAYS
23. 2ND DISCOUNT A. % B. DAYS
24. 3RD DISCOUNT A. % B. DAYS
25. NET DAYS
26. QUANTITY VARIANCE A. OVER % B. UNDER %
27. TYPE CONTRACT
28. OPR
29. DESCRIPTIVE DATA

SUBMIT COMPUTER SOFTWARE AND DOCUMENTATION IAW ATTACHMENT #2, THE CONTRACT DATA REQUIREMENTS LIST OF THE BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION.

4. ITEM NO.: 0004
5. QUANTITY*: 1
6. PURCH UNIT: LO
7. UNIT PRICE: $ N
8. TOTAL ITEM AMOUNT*: $ N
9. SCTY CLAS: U
10. ACRN: AA
11. NSN: N
12. FSCM AND PART NUMBER
13. CIRR
14. SITE CODES: A. PQA: D B. ACP: D C. FOB: D
15. NOUN: CHEMICAL ANALYSIS AND DATA
16. SVC/AGENCY USE
17. PR/MIPR DATA: FY7624-87-01628
18. AUTHORIZED RATE A. PROGRESS PAY % B. RECOUP %
19. CONTRACT PERCENT FEE %
20. SVC ID NO.
21. ITEM/PROJ MGR: FY7624
22. 1ST DISCOUNT A. % B. DAYS
23. 2ND DISCOUNT A. % B. DAYS
24. 3RD DISCOUNT A. % B. DAYS
25. NET DAYS
26. QUANTITY VARIANCE A. OVER % B. UNDER %
27. TYPE CONTRACT
28. OPR
29. DESCRIPTIVE DATA

PERFORM CHEMICAL TESTS IAW THE TASK DESCRIPTION OF THIS ORDER AND SECTION C, THE DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT. SUBMIT DATA IAW ATTACHMENT #1, THE CONTRACT DATA REQUIREMENTS LIST OF THE BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION.

*REPRESENTS NET AMOUNT OF INCREASE/DECREASE WHEN MODIFYING EXISTING ITEM NO.
N = NOT APPLICABLE
U = UNDEFINITIZED
NSP = NOT SEPARATELY PRICED

E = ESTIMATED
− (IN QTY AND $) = DECREASE
+ OR − (IN ITEM NO.) = ADDITION OR DELETION
CIRR: CONTROLLED ITEM RPT RQMT

SITE CODES: S = SOURCE, D = DESTINATION, O = INTERMEDIATE

STATEMENT OF WORK

THE INSTALLATION RESTORATION PROGRAM
STAGE 2

Selfridge ANGB MI

I. DESCRIPTION OF WORK

1.1 Scope. The objective of the Air Force Installation Restoration Program (IRP) is to assess past hazardous waste disposal and spill sites on Air Force installations and develop remedial actions consistent with the National Contingency Plan (NCP) for those sites which pose a threat to human health and welfare or the environment. The intent is to conduct the remedial investigation and feasibility study in parallel, where feasible, instead of in serial fashion. The USAFOEHL/TS Handbook, mailed under separate cover, is an integral part of this task and the contractor shall comply with all Handbook requirements. Section 1 of the Handbook lists all documents that apply to this Statement of Work. The contractor shall accomplish the following actions for this stage 2 of the IRP process at Selfridge ANGB MI:

a. literature search,

b. determination of public health and environmental requirements,

c. field investigation,

d. qualitative risk assessment,

e. scoping and initial screening of remedial actions,

f. development of data quality objectives (DQOs),

g. preparation of a final report.

1.2 Literature search. Conduct a literature search to determine the geological, hydrogeological, and environmental settings for this investigation. Requirements are supplied under separate cover (see "Environmental Setting", Section II of the Report Format, contained in Section 3, USAFOEHL/TS Handbook). When gathering information for the demographic setting and conducting the well inventory, consider only those populations and wells within a one mile radius of the base. Sources include: IRP Phase I Report, IRP Phase II Stage 1 Report, Federal and State geological agency reports, academic theses and related university research, municipality and county reports, and historical and current aerial photographs. Cite all bibliographic references reviewed, including personal communications, in the appropriate part of the report. Identify gaps in data or analysis that prevent an adequate determination of contaminant migration patterns or other factors that are critical to assessing the hazard potential associated with the individual sites.

1.3 Public Health and Environmental Requirements. Determine the necessary requirements to develop data quality objectives (DQOs), and to

evaluate the threat of contaminants to public health and welfare or the environment through a literature search of documents identified under separate cover (USAFOEHL/TS Handbook, Section 2). This effort shall satisfy the requirement in the CERCLA amendments of 1986 to identify all Applicable or Relevant and Appropriate Requirements (ARARs).

1.4. **Field Investigation.**

1.4.1 **Drilling supervision.** The field investigation including all drilling and sampling operations shall be supervised by a registered geologist or hydrogeologist. A detailed log of the conditions and materials penetrated during the course of the work shall be maintained by the geologist/hydrogeologist on site. Decisions on well locations, well depths, screened intervals, and other well construction details shall be made collectively by the ANGSC POC, USAFOEHL Technical Program Manager (TPM) and the supervising geologist/hydrogeologist.

1.4.2 **Regulatory requirements and permits.** All well drilling, development, purging, sampling methods, and other activities pertaining to this effort must conform to state and other applicable regulatory agency requirements. Cite references in an appendix to the Final Report (paragraph 1.9.1). Complete permits, applications, and other documents which may be required by local and/or state regulatory agencies for the installation of test wells. File these documents with appropriate agencies and pay all permitting and filing fees.

1.4.3 **Borehole Installation.**

1.4.3.1 **Soil borings.** Accomplish all borings using hollow-stem auger techniques. Conduct a maximum of twenty nine (29) soil borings not to exceed a total of 870 linear feet (see Annex A, Table A-3 for distribution by site). Obtain boring samples using the CME Continuous Sample Tube System or its equivalent.

1.4.3.1.1 Monitoring soil cores. Scan all soil cores with a photoionization meter or equivalent organic vapor detector. Include monitoring results in the boring logs.

1.4.3.2 **Lithologic samples.** Describe lithologies of drill cuttings at three (3) foot intervals and prepare borehole log descriptions. Include pilot boring logs and well completion summaries in the Final Report (paragraph 1.9.1). Monitor all cuttings at the interval specified with an HNu or organic vapor analyzer (OVA) and record the vapor levels detected.

1.4.3.3 **Air monitoring during drilling.** Monitor the ambient air during all well drilling and soil boring work with a photoionization meter or equivalent organic vapor detector to identify the generation of potentially hazardous and/or toxic vapors or gases. Include air monitoring results in the boring logs. If soil encountered during borehole drilling is suspected to be hazardous because of abnormal discoloration, odor or air monitoring levels, containerize the soil cuttings in new, unused drums. Contractor is responsible for providing all necessary containers, i.e., 55-gallon drums. The contractor shall be responsible for transporting drums containing suspected contaminated soils. The contractor shall be responsible for the

ultimate disposal of contaminated soils in accordance with current Federal, State, and/or local hazardous waste disposal laws. The contractor shall provide a final, completed copy of the hazardous waste manifest document to the ANGSC/SGPB Point of Contact as referenced in paragraph V. Enter into the boring logs the depths(s) from which suspected contaminated soil cuttings were collected. *Estimates for drum disposal shall be based on a cost for seven drums to be disposed in a Class A Hazardous Waste Landfill.*

1.4.3.4 **Soil Toxicity Sampling.** Collect a maximum of 3 composite samples, one from the contents of each drum specified in paragraph 1.4.3.3. Test each composite sample for metals (EP Toxicity 40 CFR 261.24), for volatile organic compounds (Method SW5030/SW8240), to determine if the soil cuttings must be disposed of as hazardous waste.

1.4.3.5 **Water level measurements.** Whenever possible, measure water levels in all boreholes after the water level has stabilized. Examine the water surface for the presence of hydrocarbons. Include this information in the boring logs.

1.4.3.6 **Sealing boreholes.** For those boreholes that will not be converted to test wells, tremie-grout the borehole to the surface with a bentonite/cement slurry. Boreholes must be adequately resealed to preclude future migration of contaminants.

1.4.3.7 **Marking borehole locations.** Permanently mark each soil boring location. Record the location on a project map for each specific site or zone, whichever is applicable.

1.4.4 **Well Installation.** Drill a maximum of 39 wells (see Annex A, Table A-3 for distribution by site). Total footage for all wells in this task shall not exceed 910 linear feet. Total screening for all wells in this task shall not exceed 475 linear feet.

1.4.4.1 **Well drilling.** Drill all wells using hollow-stem auger techniques. Each "well cluster" shall contain two individual wells. One shallow monitoring well ~~penetrating the first aquifer~~ and one deep monitoring well. ~~penetrating the next underlying aquifer.~~ Avoid installing wells in depressions or areas subject to frequent flooding and standing water. If wells must be installed in such areas, design the wells such that standing water does not leak into the top of the casing or cascade down the annular space.
Well at two depths are necessary to measure vertical gradients in the aquifer.

~~a. Prevent cross-contamination between aquifers by using a dual casing system. Where wells extend through the most shallow aquifer and into a deeper acquifer, install an outer conductor casing into the confining layer below the shallow aquifer. Grout the annular space to the surface with bentonite.~~

1.4.4.2 **Well casing requirements.** Construct each shallow well with two-inch inside diameter (I.D.) ~~Schedule 40 PVC~~ *stainless steel* casing. Use threaded screw-type joints only. ~~Glued fittings are not permitted.~~ Flush thread all connections.

1.4.4.3 **Well depth.** Install wells at a sufficient depth to collect samples representative of aquifer quality and to intercept contaminants if they are present. The estimated average depth of shallow and deep wells are

15 and 35 feet, respectively. Shallow wells denotes those installed into the first aquifer. Deep wells shall be drilled and installed into the aquifer directly below the shallow aquifer.

1.4.4.4 **Lithologic samples.** Observe drill cuttings for stratigraphic control purposes and prepare borehole log descriptions. The deepest well point of each cluster shall be drilled first, using the CME Continuous Sample Tube System or its equivalent, to define site stratigraphy.

a. Scan all continuous cores with a photoionization meter or equivalent organic vapor detector. Include monitoring results in the boring logs and submit log in the Final Report. (Item VI, Sequence 4, Paragraph 6.1).

1.4.4.5 **Well screening requirements.**

a. Screen each shallow well using two-inch I.D. stainless steel screen ~~PVC casing~~ having up to 0.020 inch slots. Slot size may be smaller based upon borehole geology. Each well screen shall be a maximum of fifteen (15) feet in length. Cap the bottom of the screen.

b. Screen all wells so as to collect floating contaminants and to allow for all yearly fluctuations of the water table. Screen all wells a minimum of ten (10) feet.

c. Once the casing is in place, install the sand pack. Supplement the natural gravel pack with washed and bagged rounded silica sand or gravel with a grain size distribution compatible with the screen and soil formation. Place the pack from the bottom of the borehole to two (2) feet above the top of the screen. Tremie a two (2) foot bentonite seal (granulated or pellets) above the sand/gravel pack. Ensure that the bentonite forms a complete seal. Grout the remainder of the annulus to the land surface with a Type I Portland cement/bentonite slurry.

1.4.4.6 **Well completion.** Complete all test wells using the following specifications:

a. Coordinate with the Base Point of Contact (POC) to determine well completion (flush or projected above the ground surface) requirements. Monitoring wells should be completed as soon as possible, within 24 hrs of installing casing and screen to ensure well security.

(1) If well stick-up is of concern in an area, complete the well flush with the land surface. Cut the casing two to three inches below land surface, and install a protective locking lid consisting of a cast iron valve box assembly. Center the lid assembly in a three (3) foot diameter concrete pad sloped away from the valve box. Ensure that free drainage is maintained within the valve box. Also, provide a screw-type casing cap to prevent infiltration of surface water. Maintain a minimum of one (1) foot clearance between the casing top and the bottom of the valve box. Clearly mark the well number on the valve box lid and well casing using an impact labeling method.

(2) If an above-ground-surface completion is used, extend the well casing two or three feet above land surface. Provide an end plug or

casing cap for each well. Shield the extended casing with a steel guard pipe (sleeve) which is placed over the casing and cap, and seated in a two-foot by two-foot by four-inch (2' X 2' X 4") concrete surface pad. Slope the pad away from the well sleeve. Install a lockable cap or lid on the guard pipe. Install three (3), three-inch diameter cement-filled steel guard posts if the Base POC determines the well is in an area which needs such protection. The guard posts shall be five (5) feet in total length and installed radially from each wellhead. Recess the guard posts approximately two (2) feet into the ground and set in concrete. Do not install the guard posts in the concrete pad placed at the well base. Fill each guard post with concrete. Clearly mark the well number on the well sleeve exterior using both paint and impact lettering. Base POC will specify color to blend with paint scheme of the base.

b. Provide locks for both flush and above-ground well assemblies. The locks must either have identical keys or be keyed for opening with one master key. Turn over the lock keys to the Base POC following completion of the field effort.

c. Include well completion summaries in the Final Report (paragraph 1.9.1).

1.4.4.6 **Well logs.** For each well, prepare a well log/well schematic showing how the well was constructed.

1.4.4.7 **Well development.** Develop each well as soon as practical after completion with a submersible pump, bailer, and/or airlift method. Redevelop existing wells prior to resampling. Continue well development until the discharge water is clear and free of sediment to the fullest extent possible. Measure the rate of water production, the pH, specific conductance, and water temperature during well development and include this information in the Final Report (paragraph 1.9.1). Containerize development and purge water from those wells where soils were containerized during boring operation. Analyze a maximum of two (2) samples for the parameters shown in paragraph 1.4.3.4. Notify the base point-of-contact of the results of the analyses a maximum of one week after verifying results.

1.4.4.8 **Slug Tests.** Perform a slug test on each of the 62 wells (39 newly installed, 23 existing) sampled in this effort to determine hydraulic conductivity. Provide results of these tests in the final report.

1.4.4.9 **Surveying.** Determine by certified land surveyor the elevations and locations of all newly installed test wells, both top of casing and ground surface immediately next to well, soil borings, and sampling points. This shall be a third order survey. Notch the top of the riser casing where well elevations are established. Record the positions on both project and site specific maps. Bench marks used must have previously been established from and be traceable to a USCGS or USGS survey marker. Clearly identify all bench mark locations on the base map.

1.4.4.10 **Water level measurements.** Measure water levels at all test wells as feet below the top of casing elevation to the nearest 0.01 foot. Report as mean sea level (MSL). Measure static water levels in wells prior to well development and before all well purging which precedes sampling events.

1.4.4.11 **Well abandonment.** Recommend well abandonment method(s) or technique(s) which are applicable to the type of test wells installed and the geological conditions. Consider that these wells will be abandoned at some future date after the study objectives have been met and there is no longer a need for the wells. The actual process of well abandonment is not a part of this task order. Insure that the recommended method(s) is consistent with state and local well abandonment guidelines or regulations.

1.4.5 **Well and Boring Precautions.** Mark the field locations of all test wells, soil borings, and shallow soil augerings during the planning/ mobilization phase of the field investigation. Consult with base personnel to minimize disruption of base activities, to properly position wells with respect to site locations, and to avoid underground utilities. A utilities map, if available, shall be consulted before any drilling or boring activities take place.

1.4.6 **Well and borehole cleanup.** Remove all well/borehole cuttings per direction of base civil engineer and clean the general area following the completion of each well/borehole. Containerize and store cuttings suspected to be contaminated according to Paragraph 1.4.3.3. Transport these drums to a location within the installation boundary designated by the Base POC. The base is responsible for ultimate disposal of contaminated soils using base resources.

1.4.7 **Continuous Water Level Recorder**

When applicable as stated in Section 1.4.10 install continuous water level recorders in order to accomplish 3 main goals:

1. Groundwater diurnal effect

2. Establish groundwater, surface water, and rainfall

3. Estimate hydraulic conductivity from this data using USGS Cyclic Water-level fluctuations (Water Supply Paper 1536-I, pp. 305 to 318)

These goals shall be accomplished by the following procedure:

1. Install one water-level recorder in a nearby storm drain

a. Survey this storm water sampling station for elevation and coordinates, and install a staff gage.

b. Install a still well to host recorder to reduce wave actions.

c. Provide a shelter for this instrument.

d. Follow USGS Techniques of Water-Resources Investigation: Stage Measurement at Gaging Station, Book 3, Chap A7, 1968

2. Install a second water-level recorder in a sampling well close by the above stated storm drain.

a. All instrumentation put in the sampling well shall be decontaminated first.

b. Provide a shelter for this instrument.

3. Secure rainfall data for the same measuring period of water levels, 12 consecutive weeks, from the base weather detachment or other official source.

1.4.8 **Sample Collection.**

1.4.8.1 **Ground and surface water samples.** Collect a maximum of 62 groundwater and 48 surface water samples. The maximum number of analyses for each parameter is given in Table A-4, Annex A.

1.4.8.2 **Soil and sediment samples.** Collect a maximum of 84 soil and sediment samples. The maximum number of analyses for each parameter is given in Table A-5, Annex A.

1.4.9 **Detailed requirements for sampling and analysis.** Refer to Annexes B and C for detailed requirements on field sampling, sample preservation, sample holding times, sampling equipment decontamination, and chemical analysis.

a. All chemical/physical analyses shall conform to state and other applicable Federal and local regulatory agency legal requirements. If a regulatory agency specifies that a type of analysis be performed in a certified laboratory, assure compliance with the requirement and furnish documentation showing laboratory certification with the first analytical data supplied to the USAFOEHL/TS.

b. Archiving Data. Archive all raw data, including QA/QC and standards data, for not less than five years after project completion. Supply these data to the USAFOEHL/TS upon request.

1.4.10 **Specific Site Requirements.**

1.4.10.1 **Site No. 1 - Southwest Landfill**

a. Drill and construct four "well Clusters", (individual wells). Each well cluster shall contain one shallow monitoring well penetrating the first aquifer and one deep monitoring well penetrating the next underlying aquifer.

b. Collect one groundwater sample from each of the eight new wells and one sample from each of the existing wells (MW-22, MW-23, MW-24, MW-25) at this site. Analyze each sample for parameters listed in Annex A, Table A-1. A total of 12 groundwater samples shall be collected at this site.

c. Two storm water runoff sampling stations shall be established. One at the manhole port north of the landfill and the other near the West Pump House (Building 507). The invert elevation of the storm drain at these points shall be established by survey or by inspection at existing engineering records.

d. Two rounds of samples shall be obtained from the previous sampled impounds (Pond 1, Pond 2, Pond 3) and the two new storm water sampling stations. One round shall be obtained immediately after an above-freezing precipitation event; the other round should be obtained after a dry period of substantial duration. Analyze water samples for parameters listed in Annex A, Table A-1. A total of 10 surface water samples shall be collected.

e. Continuous water level recorders shall be installed near the northern edge of the landfill according to specifications listed in 1.4.7.

f. Based on the HNµ organic vapor analyzer results, submit a maximum of four soil samples to the laboratory for analysis. Analyze samples for the parameters listed in Annex A, Table A-2.

1.4.10.2 Site No. 2 - Fire Training Area - 2

a. Install three soil borings within the training burn area. Use the CME continuous sample tube system or its equivalent to define site stratigraphy. Each boring shall be an average of 30 feet deep. Monitor the samples with an OVA or HNµ meter. Based on the OVA or HNµ reading, discoloration, odor, and other anomalies, take a maximum of three soil samples per hole (maximum of 9) for analyses.

b. Analyze each soil sample for parameters listed in Annex A, Table A-2.

c. Drill and construct one shallow groundwater sampling well approximately 20 feet northeast of well No. 20 which has been destroyed in a fire training exercise.

d. Collect one groundwater sample from each of the two existing wells (MW-19, MW-21) and one sample from the new well. Analyze all three groundwater samples for parameters listed in Annex A, Tabel A-1.

e. Abandon well No. 20 to meet state and/or local well abandonment regulations.

f. Two storm water runoff sampling stations shall be established. One at the manhole port east of this site and the other at a manhole port west of this site. The invert elevation of the storm drain at these points should be established by survey or by inspection of existing engineering records.

g. Two rounds of samples shall be obtained from each of the previous sampled impoundments (Pond A and Pond B) and the two storm water sampling stations. One round should be obtained immediately after an above-freezing precipitation event; the remaining round should be obtained after a dry period of substantial duration. All 8 surface water samples shall be analyzed for parameters listed in Annex A, Table A-1.

1.4.10.3 Site No. 3 - Fire Training Area-1

a. Install three soil borings within the training burn area. Use the CME continuous sample tube system or its equivalent to define site

stratigraphy. Each boring is estimated to be an average of 30 feet deep. Monitor the samples with a OVA or HNμ meter. Based on the OVA or HNμ reading, discoloration, odor, and other anomalies, take a maximum of three soil samples per hole (maximum of 9) for analysis.

b. Analyze all soil samples for parameters listed in Annex A, Table A-2.

c. Collect one groundwater sample from each of the three existing wells (MW-16, MW-17, MW-18). Analyze all three groundwater samples for parameters listed in Annex A, Table A-1.

1.4.10.4 **Site No. 4 - West Ramp**

a. Drill and construct four "well clusters". Each "well cluster" shall contain one shallow monitoring well penetrating the first aquifer and one deep monitoring well penetrating the next underlying aquifer. Locate all four "well clusters" around entire perimeter of the West Ramp with one of these "well clusters" being placed near monitoring well No. 14 if it has been destroyed.

b. Install ten soil borings, one adjacent to each of the ten storm drainage catch basins around the perimeter of the site. Each boring shall be installed using the CME Continuous Sample Tube System or its equivalent to define site stratigraphy. Each boring is estimated to be an average of 30 feet deep. Monitor the samples with an OVA or HNμ meter. Based on the OVA or HNμ reading, discoloration, odor, and other anomalies, take a maximum of three soil samples per hole (maximum of 30) for analysis. Analyze all soil samples for parameters listed in Annex A, Table A-2.

c. Four storm water sampling stations shall be established. Two at manhole points around the western perimeter and two stations around the eastern perimeter at manhole points. Establish the invert elevation of the storm drains at these points by survey or by inspection of existing engineering records.

d. Two rounds of samples shall be obtained from each of the storm water sampling stations. One round shall be obtained immediately after an above-freezing precipitation event; the remaining round shall be obtained after a dry period of substantial duration. Analyze all 8 surface water samples for parameters listed in Annex A, Table A-1.

e. Collect one groundwater sample from each of the existing wells (MW-11, MW-12, MW-13, MW-15) and one sample from each of the 8 new monitoring wells. Analyze a maximum of 12 groundwater samples for parameters listed in Annex A, Table A-1.

f. Continuous water level recorders shall be installed near the northeast corner of west ramp according to specifications listed in 1.4.7.

g. Abandon well No. 14 which has been destroyed to meet state and/or local well abandonment regulations.

1.4.10.5 - Site No. 5 - Tucker Creek Landfill

a. Drill and construct three "well clusters". Each "well cluster" shall contain one shallow monitoring well penetrating the first aquifer and one deep monitoring well penetrating the next underlying aquifer. Locate each "well Cluster" around the eastern and northern perimeter of the landfill.

b. Collect one groundwater sample from each of the six new wells and one sample from each of the existing wells (MW-5, MW-6, MW-7). Analyze all 9 samples for parameters listed in Annex A, Table A-1.

c. Install eight soil borings, one adjacent to each of the eight storm drainage catch basins in the immediate vicinity of Tucker Creek Landfill. Each boring shall be installed using the CME Continuous Sample Tube System or its equivalent to define site stratigraphy. Each boring is estimated to be an average of 30 feet deep. Monitor the samples with a OVA or HNµ meter. Based on the OVA or HNµ reading, discoloration, odor, and other anomalies, take a maximum of three soil samples per hole (maximum of 24) for analyses. Analyze all soil samples for parameters listed in Annex A, Table A-2.

d. Five storm water sampling stations shall be established at five manhole points in the immediate vicinity of the landfill. The invert elevation of the storm drain at these points shall be established by survey or by inspection of existing engineering records.

e. Two rounds of samples shall be obtained from each storm water sampling station. One round shall be obtained immediately after an above-freezing precipitation event, the remaining round shall be obtained after a dry period of substantial duration. Analyze all 10 surface water samples for parameters listed in Annex A, Table A-1.

1.4.10.6 - Site No. 6 - Northwest Landfill

a. Drill and construct two "well clusters" around the eastern and northern perimeter of the landfill. Each well cluster shall contain one shallow monitoring well penetrating the first aquifer and one deep monitoring well penetrating the next underlying aquifer.

b. Based on the HNµ or organic vapor analyzer results, submit a maximum of two soil samples to the laboratory for analysis. Analyze samples for the parameters listed in Annex A, Table A-2.

c. Collect one groundwater sample from each of the four new wells and one sample from each of the existing wells (MW-8, MW-9, MW-10). Analyze all 7 samples for parameters listed in Annex A, Table A-1.

d. Two storm water sampling stations shall be established at two manhole ports southwest of the landfill. The invert elevation of the storm drain at these points shall be established by survey or by inspection of existing engineering records.

e. Two rounds of samples shall be obtained from each storm water sampling station. One round shall be obtained immediately after an above

freezing precipitation event, the remaining round shall be obtained after a dry period of substantial duration. Analyze all four surface water samples for parameters listed in Annex A, Table A-1.

1.4.10.7 - Site No. 7 - East Ramp

a. Drill and construct four well clusters around the entire perimeter of this site. Each well cluster shall contain one shallow monitoring well penetrating the first aquifer and one deep monitoring well penetrating the next underlying aquifer.

b. Collect one groundwater sample from each of the eight new wells and one sample from each of the existing wells (MW-1, MW-2, MW-3, MW-4). Analyze all 12 samples for parameters listed in Annex A, Table A-1.

c. Four storm water sampling stations shall be established. Two stations shall be located at two manhole points around the northern perimeter and the other two stations located at two manhole points around the southern perimeter of the ramp. The invert elevation of the storm drain at these points shall be established by survey or by inspection of existing engineering records.

d. Two rounds of samples shall be obtained from each storm water sampling station. One round shall be obtained immediately after an above freezing precipitation event, the remaining round shall be obtained after a dry period of substantial duration. Analyze all eight surface water samples for parameters listed in Annex A, Table A-1.

e. Install two soil borings; one adjacent to the catch basin located in the northern corner of this site, and one boring located adjacent to the catch basin in the northwestern corner. Each boring shall be installed using the CME continuous Sample Tube System or its equivalent to define site stratigraphy. Both borings are estimated to be an average of 30 feet deep. Monitor the samples with an OVA or HNμ meter. Based on the OVA or HNμ reading, discoloration, odor, and other anomalies, take a maximum of three soil samples per hole for analyses (maximum of 6). Analyze all soil samples for parameters listed in Annex A, Table A-2.

f. Continuous water level recorders shall be installed near the southwest corner of the East Ramp according to specifications listed in 1.4.7.

1.4.10.8 - Site No. 8 - Base Coal Storage Pile Adjacent to Civil Engineering Complex

a. Drill and construct four shallow sampling wells around the perimeter of this site. Locate one well hydralically upgradient to groundwater flow. Locate the other three wells hydraulically downgradient. While drilling, use the CME Continuous Sample Tube System or its equivalent to define site stratigraphy.

b. Collect one groundwater sample from each of the four new wells. Analyze all 4 samples for parameters listed in Annex A, Table A-1.

c. Install 3 soil borings around the immediate peripheral edges of the coal pile. Each boring shall be installed using the CME continuous sample Tube system or its equivalent to define site stratigraphy. Each boring is estimated to be an average of 30 feet deep. Based on the OVA or HNµ reading, discoloration, odor, and other anomalies, take a maximum of three soil samples per hole for analyses (maximum of 9). Analyze all soil samples for parameters listed in Annex A, Table A-2.

1.5 **Qualitative Risk Assessment.** After a thorough review of all data gathered during the field investigation and the establishment of ARARs (1.3.) determine the potential risk to human health or welfare and the environment from the contaminants identified at the various sites investigated. Do the following:

a. Identify the physical and chemical characteristics of the site contaminants (e.g., toxicity, carcinogenicity, flammability, etc.).

b. Identify release mechanism (e.g., volatilization, leaching) and estimate the volume of contaminants released or being released at each IRP site.

c. Identify potential human and environmental receptors and receptor characteristics which might increase vulnerability to the effects of contaminants.

d. Determine potential contaminant exposure pathways (e.g., direct contact, inhalation of vapors/dust, ingestion of contaminated water or soil, ingestion of aquatic organisms).

e. Determine representive rates of migration associated with individual sites. Rates of flow, groundwater velocities, and times necessary to reach receptors shall be calculated based on a range of conservative assumptions.

f. Identify those IRP sites having no significant impact upon human health and welfare or the environment (i.e., a "finding of no significant impact" or FONSI).

g. Identify those IRP sites which pose an immediate and direct health hazard and require remedial actions.

h. Score all IRP sites where a remedial alternative has been selected using the Defense Prioritization System (DPS) (copy mailed under separate cover).

i. Include results of the qualitative risk assessment in Section IV of the Final Report (paragraph 1.9.1).

1.6 **FONSIs.** Using the forms/format provided by the Technical Program Manager (copies mailed under separate cover), prepare draft FONSIs for each IRP site where the results of this initial investigation indicate that there is no significant threat to human health and welfare or the environment (paragraph 1.9.2.4).

1.7 Preliminary alternative remedial actions. For all past hazardous waste disposal and spill sites investigated at Selfridge ANGB MI, except those where a FONSI is applicable, utilize the data and conclusions obtained from the hydrogeological survey, site characterization, and qualitative risk assessment to develop preliminary alternative remedial actions. Do the following:

a. Identify general response actions, or classes of responses. General response actions considered should include the "no action" alternative as a baseline against which others can be measured.

b. Identify possible technologies for each general response action identified.

c. Screen the technologies to eliminate inapplicable and infeasible technologies based on site conditions, waste characteristics, and technical requirements. Eliminate or modify those technologies that may prove extremely difficult to implement, be unproven, will require unreasonable time periods, that do not effectively contribute to the protection of public health and welfare or the environment, or that may have significant adverse effects. Give special consideration to those technologies that permanently contain, immobilize, destroy, or recycle contaminants, and technologies that promote energy recovery. Cost as a screening factor should only be used to discriminate among technologies which provide similar results. A technology which will result in destruction or reduction of waste's mobility, toxicity, and volume (MTV), although it may have a high capital cost, should not be eliminated.

d. If applicable, group the technologies into operable units (OUs). An operable unit is a discrete part of the entire response action that decreases a release, threat of release, or pathway of exposure.

e. Develop remedial alternatives based upon the technologies remaining after the initial screening. Alternatives developed shall include the following categories:

(1) Alternatives for off-site treatment or disposal

(2) Alternatives that attain ARARs

(3) Alternatives that exceed ARARs

(4) Alternatives that do not attain ARARs

(5) No action

Further, alternatives outside of these categories may also be developed, such as non-cleanup alternatives (e.g., alternative water supply, relocation, etc.).

f. Documentation of the remedial alternative development process, including the decision rationale, shall be included in Section V of the Final Report (paragraph 1.9.1). The finalized list of preliminary remedial alternatives shall be placed in Section VI of the Final Report.

1.8 **Data quality objectives (DQOs).** Identify and define the data quality objectives (DQOs) necessary to perform the detailed evaluation of remedial alternatives and to conduct the quantitative risk assessment required in any follow-on IRP task order. Incorporate the DQOs into Section V of the Final Report (paragraph 1.9.1).

1.9 **Reports**

1.9.1 **Final Report.** Prepare a draft Final Report delineating all findings from this initial investigative stage of the remedial investigation/feasibility study. This Final Report must also include a detailed discussion of the recommended alternative remedial actions and a description of the work proposed, including the Data Quality Objectives (DQOs), for any follow-on remedial investigation and feasibility study that may be required. Forward the report to the USAFOEHL/TS for Air Force and regulatory agency review (Item VI, Sequence No. 4, paragraph 6.1).

1.9.1.1 **Tables and figures.** All data relevant to the findings of this investigation that were captured in the field or made available through other studies shall be tabulated for analysis and review. The contractor shall provide as many tables and figures as possible. Lists of required figures and tables are found as attachments to the Report Format (USAFOEHL/TS Handbook, Section 3). All figures and tables shall be clear and easy to interpret, shall be of publishable quality, and shall contain legends that identify the symbols used for the purposes of illustration.

1.9.1.2 **Descriptive Statistics.** This information (See Section 10 of Handbook) will be incorporated into the Air Force Information Management System (IRPIMS) and shall not be considered as part of the Draft or Final Report.

1.9.1.3 **Draft reports.** Draft reports are considered "drafts" only in the sense that they have not been reviewed and approved by the Air Force. In all other respects, "drafts" must be complete, in the proper format, and free of grammatical and typographical errors. All draft reports shall be thoroughly screened through in-house peer technical review before being released to USAFOEHL/TS.

1.9.1.4 **Report format.** Strictly adhere to the USAFOEHL/TS report format (USAFOEHL/TS Handbook, Section 3, mailed under separate cover) for preparation of draft and final reports. This format is an integral part of the delivery order.

1.9.1.5 **Microfiche copies of final report.** Provide three (3) microfiche copies of the approved final report (Item VI, Sequence No. 17, Paragraph 6.1).

1.9.2 **Plans for Current Effort.**

1.9.2.1 **IRP Work Plan for Stage 2.** Use the Work Plan Format provided under separate cover (USAFOEHL/TS Handbook, Section 4). The work plan is due six (6) weeks after Notice to Proceed (NTP). Distribute copies of the work plan as specified by USAFOEHL/TS (Item VI, Sequence No. 4, Paragraph 6.1).

1.9.2.2 **Quality Assurance Project Plan (QAPP) for Stage 2.** Use the QAPP Format provided under separate cover (USAFOEHL/TS Handbook, Section 5). The QAPP is due eight (8) weeks after Notice to Proceed (NTP) (Item VI, Sequence No. 4, paragraph 6.1).

1.9.2.3 **Health and Safety Plan for Stage 2 .** Provide a written Health and Safety Plan within three (3) weeks after NTP (Item VI, Sequence No. 4, Paragraph 6.1). Comply with USAF, OSHA, EPA, state and local health and safety regulations regarding the proposed work effort. Use EPA guidelines for designating the appropriate levels of protection needed at the study sites. Coordinate the Health and Safety Plan directly with applicable regulatory agencies prior to submittal to USAFOEHL/TS.

1.9.2.4 **FONSIs.** Incorporate FONSIs into an appendix of the Final Report (paragraph 1.9.1). Provide five (5) copies of each FONSI to the ANGSC POC after approval by the USAFOEHL/TS TPM (Item VI, Sequence No. 4, Paragraph 6.1).

1.9.2.5 **R & D Status Reports.** Include all data as required by the USAFOEHL/TS Handbook, Section 6 (provided under separate cover). Tabulated field and laboratory test results and QA/QC data shall be incorporated into the next monthly R & D Status Report as they become available and forwarded to the USAFOEHL/TS (Item VI, Sequence No. 1, Paragraph 6.1).

1.9.2.6 **Data Management.** In addition to the hard copy of the field and laboratory test results submitted with the monthly R & D Status Report, data collected in this effort shall be archived with Air Force compatible computer hardware and software and forwarded to the USAFOEHL/TS per format and media instruction provided (USAFOEHL/TS Handbook, Section 7) (Item VI, Atch 2, Sequence No. 1, Paragraph 6.2).

1.9.2.7 **Informal Technical Report (ITR).** Upon completion of all analyses, tabulate and incorporate all results into an Informal Technical Information Report and forward the report to USAFOEHL/TS no later than three (3) weeks after all analyses have been completed (Item VI, Sequence 3, Paragraph 6.1). Use the format provided in the USAFOEHL/TS Handbook, Section 8, provided under separate cover.

1.9.3 **Plans for Followup Effort.** The contractor shall initiate preparation of plans for the followup effort only after all regulatory agency and Air Force comments have been incorporated into the second Draft Report. The followup plans shall be delivered at the same time as the Final Report (paragraph 1.9.1).

1.9.3.1 **IRP Work Plan For Next Effort (IRPWP-3).** Use the Work Plan Format provided under separate cover (USAFOEHL/TS Handbook, Section 4). Forward all copies to the USAFOEHL/TS (Item VI, Sequence No. 4, Paragraph 6.1).

1.9.3.2 **QAPP for Next Effort (QAPP-3).** Use the QAPP Format provided under separate cover (USAFOEHL/TS Handbook, Section 5). Forward all copies to USAFOEHL/TS (Item VI, Sequence No. 4, Paragraph 6.1).

1.9.3.3 **Cost Data.** In a separate letter to the final work plan, submit a lump sum cost estimate for work required to complete any follow-on effort (Item VI, Sequence No. 2, paragraph 6.1).

1.10 **Meetings.** A maximum of three (3) contractor personnel shall attend three (3) meetings at Selfridge ANGB MI. Each meeting shall be two 8 hour workdays in duration. All meetings shall be coordinated by USAFOEHL/TS.

1.11 **Special Notifications.** Immediately report to the USAFOEHL/TS Technical Program Manager or his supervisor, via telephone, data/results generated during this investigation which indicate an imminent health risk. Follow the telephone notification with a written notice within three (3) days and attach a copy of the laboratory raw data (e.g., chromatograms, standards used for calibration, etc.).

II. SITE LOCATION AND DATES:

Selfridge ANGB, MI
Date to be established

III. BASE SUPPORT

The Base will:

3.1 Locate underground utilities and issue digging or other appropriate permits to the IRP contractor prior to the commencement of digging or drilling operations.

~~3.2 Assign accumulation points within the installation for the contractor to deliver any drill cuttings or well installation/development fluids generated from the required work which are suspected to be hazardous. The contractor is responsible for providing all necessary containers (55-gallon drums) and for transporting the containerized material to the accumulation point.~~ (This paragraph was deleted per Lt Dietzel 7/25/87 A staging area in case is necessary to collect drums prior to disposal. This support is currently being coordinated with Selfridge ANGB)

3.3 Provide the contractor with existing engineering plans, drawings, diagrams, aerial photographs, etc., to evaluate IRP sites under investigation.

3.4 Provide the contractor with their hazardous waste generator number and sign the hazardous waste manifest in the event hazardous material is encountered.

3.5 Arrange for, and have available prior to the start up of field work, the following services, materials, work space, and items of equipment to support the contractor during the investigation:

a. Personnel identification badges, vehicle passes and/or entry permits.

b. A secure staging area (approximately 1000 square feet) for storing equipment and supplies.

c. A supply (e.g., fire hydrant, stand pipe, etc.) of large quantities of potable water for borehole flushing, equipment cleaning, etc.

d. A paved area where drilling equipment can be cleaned and decontaminated. A source of potable water (i.e., ordinary outdoor water faucet) and a 110/115 VAC electrical outlet must be available within 25 feet of the paved area for steam cleaner hookup. Drainage from this paved area should be through an oil/water separator to a sanitary sewer.

e. A set of keys to the locks on any existing test/monitoring wells at Selfridge ANGB MI. The keys shall be returned to the Base POC by the contractor when the survey has been completed.

IV. GOVERNMENT FURNISHED PROPERTY: None.

V. GOVERNMENT POINTS OF CONTACT:

5.1 USAFOEHL/TS
Technical Program Manager (TPM)
2Lt Dale J Dietzel
Brooks AFB TX 78235-5501
(512) 536-2158
AV 240-2158/2159
1-800-821-4528

5.2 Selfridge ANGB MI
Base Monitor/Point of Contact (POC)
Mr Harlan Faulk
Det 1, HQ MIANG/SGC
Selfridge ANGB MI 48045
(313) 466-4701
AV 273-4701

5.3 ANGSC/SGPB
MAJCOM POC
Lt Col Michael C. Washeleski
Andrews AFB MD 20331-6008
(301) 981-5926
AV 858-5926

VI. DELIVERABLES

6.1 Attachment 1 of the basic contract. In addition to Sequence numbers 1, 5 and 11 listed in Attachment 1 to the basic contract which apply to all orders, the Sequence numbers and dates listed below are applicable to this order:

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
4 (Work Plan)	I.1.9.2.1	ONE/R	87 Oct 16	87 Nov 06	88 Jan 26	20
4 (QAPP)	I.1.9.2.2	ONE/R	87 Oct 23	87 Nov 20	88 Feb 09	20
4 (Health & Safety)	I.1.9.2.3	ONE/R	87 Oct 06	87 Oct 16	88 Jan 26	20
4 (FONSIs)	I.1.9.2.4	ONE/R	88 Jan 31	88 Feb 09	88 Sep 23	****
4 (Tech. Rpt)	I.1.9.1	ONE/R	88 Jan 31	88 Feb 09	88 Sep 23	**
3 (ITR)	I.1.9.2.7	OTIME	*	*	-	4
4 (Work Plan-3)	I.1.9.3.1	ONE/R	88 May 15	88 Sep 23	88 Dec 30	4

4 (QAPP-3)	I.1.9.3.2	ONE/R	88 May 15	88 Sep 23	88 Dec 30	4
2 (Cost Ltr)	I.1.9.3.3	OTIME	88 May 15	88 Dec 30	-	1
14		MTHLY	87 Oct 30	87 Nov 16	***	3
15		MTHLY	87 Oct 30	87 Nov 16	***	3
17 (Microfiche)	I.1.9.1.5	OTIME	88 Sep 30	88 Oct 31	-	3

6.2 Attachment 2 of the basic contract.

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
1	I.1.9.2.6	OTIME	88 Feb 09	88 Sep 23		1

6.3 Notes.

* Upon completion of the total analytical effort and not later than three weeks after all analyses have been completed.

** One first draft report (15 copies), one second draft report (25 copies), and one final report (50 copies plus the original camera-ready copy) are required. Incorporate Air Force comments into the second draft and final reports as specified by the USAFOEHL/TS. Supply the USAFOEHL/TS with an advance copy of the first draft, second draft, and final reports for acceptance prior to distribution. Distribute the remaining 14 copies of the first draft report, 24 copies of the second draft report, and 49 copies of the final report as specified by the USAFOEHL/TS.

*** Submit monthly thereafter.

**** Five (5) copies of each FONSI shall be provided to the ANGSC POC. Forward an advance copy of each FONSI to USAFOEHL/TS for approval prior to distribution to the ANGSC POC.

ANNEX A

Table A-1

Number of Samples by Site

PARAMETER	ANALYTICAL METHOD	SWLF#1	FT-2	FT-1	West Ramp	Tucker LF	NWLF	East Ramp	Coal Pile	Total
[WATER SAMPLES]										
Alkalinity - Carbonate Bicarbonate, & Hydroxide (Insitu)	A403	22	11	3	20	19	11	20	4	110
Nitrogen, Ammonia	E530.1	22	-	-	-	19	11	-	-	52
Commom Anions (Chloride, Fluoride, Nitrate Sulfate, Orthophosphate	A429	22	11	3	12	19	11	20	4	110
Total Organic Carbon (TOC)	E415.1	22	-	-	-	19	11	-	-	52
Chemical Oxygen Demand (COD)	A508A	22	-	-	-	19	11	-	-	52
Specific Conductance (Field Test)	E120.1	22	11	3	20	19	11	20	4	110
pH (Field Test)	E150.1	22	11	3	20	19	11	20	4	110
Total Dissolved Solids	E160.1	22	11	3	20	19	11	20	4	110
Temperature (Field Test)	E170.1	22	11	3	20	19	11	20	4	110
ICP Metal Screen (23 metals)	E200.7	22	11	3	-	19	11	-	4	70
Arsenic	E206.2	22	11	3	-	19	11	-	4	70
Lead	E239.2	22	11	3	-	19	11		4	70
Mercury	E245.1	22	11	3	-	19	11		4	70
Selenium	E270.2	22	11	3	-	19	11	-	4	70
Petroleum Hydrocarbons	E418.1	22	11	3	20	19	11	20	-	106
Purgeable Halocarbons	E601	22	11	3	-	19	11	-	-	66
Acidity	E305.1	-	-	-	-	-	-	-	4	4
Extractable Priority Pollutants	E625	22	-	-	-	19	11	-	4	56
Purgeable Aromatics	SW5030/ SW8020	22	11	3	20	19	11	20	-	106

ANNEX A

Table A-2
Number of Samples by Site

PARAMETER	ANALYTICAL METHOD	SWLF#1	FT-2	FT-1	West Ramp	Tucker LF	NWLF	East Ramp	Coal Pile	Drill Cuttings	Total
[Soil Samples]											
Petroleum Hydrocarbons	SW3550/ E418.1	4	9	9	30	24	2	6	-		84
Metal Screen (23 metals)	SW3050/ SW6010	4	9	9	-	24	2	-	9		57
Arsenic	SW3050/ SW7060	4	9	9	-	24	2	-	9		57
Mercury	SW7471	4	9	9	-	24	2	-	9		57
Selenium	SW3050/ SW7740	4	9	9	-	24	2	-	9		57
Volatile Organic Compounds	SW5030/ SW8240	4	9	9	30	24	2	6	-	5	89
Semivolatile Organic Compounds	SW3550/ SW8270	4	-	-	-	24	2	-	9		39
EP Toxicity	40CFR 261.24	-	-	-	1	-	-	1	-	2	4
Soil Moisture Content	ASTM D2216	4	9	9	30	24	2	6	-	5	89

ANNEX A

Table A-3

Number of Wells, Borings, Stations and Samples by Site

SITE #	SITE NAME	# of WELLS SHALLOW	DEEP	# EXISTING WELLS	# SOIL BORINGS	# STORM WATER STA	# POND STA.	# GRNDWATER SAMPLES	# SURFACE WATER SAM	# SOIL SAMPLES	WATER RECORDERS
1	SW Landfill	4	4	4	0	2	3	12	10	4	2
2	FTA-2	1	0	2	3	2	2	3	8	9	0
3	FTA-1	0	0	3	3	0	0	3	0	9	0
4	West Ramp	4	4	4	10	4	0	12	8	30	2
5	Tucker Crk LF	3	3	3	8	5	0	9	10	24	0
6	NW Landfill	2	2	3	0	2	0	7	4	2	0
7	East Ramp	4	4	4	2	4	0	12	8	6	2
8	Coal Pile	4	0	0	3	0	0	4	0	9	0
	(Totals:)	(22)	(17)	(23)	(29)	(19)	(5)	(62)	(48)	(93)	(6)

ANNEX A

Table A-4

Analytical Methods, Detection Limits, and TOTAL Number of Analyses

PARAMETER	ANALYTICAL METHOD (a)	DETECTION LIMIT (b)	REPORTING UNITS(c)	NUMBER OF ANALYSES	DUP/REP	AMB COND BLANKS	TRIP BLANKS	EQUIP BLANKS	SECOND COLUMN	TOTAL ANALYSES
[WATER SAMPLES]										
Alkalinity - Carbonate Bicarbonate & Hydroxide	A 403	10	mg/L	110	11	-	-	11	-	132
Nitrogen, Ammonia	E350.1	0.01	mg/L	52	6	-	-	6	-	64
Common Anions (Chloride, Fluoride, Nitrate, Sulfate, Orthophosphate)	A429	0.5	mg/L	110	11	-	-	11	-	132
Total Organic Carbon (TOC)	E415.1	1	mg/L	52	6	-	-	6		64
Chemical Oxygen Demand	A508A	5	mg/L	52	6	-	-	6	-	64
Specific Conductance (Field Test)	E120.1	-	umhos/cm	110	-	-	-	-	-	110
pH (Field Test)	E150.1	-	pH Units	110	-	-	-	-	-	110
Total Dissolved Solids(TDS)	E160.1	10	mg/L	110	11	-	-	11	-	132
Temperature (Field Test)	E170.1	-	deg C	110	-	-	-	-	-	110
Metal Screen (23 metals)	E200.7	(d)	mg/L	70	7	-	-	7	-	84
Arsenic	E206.2	0.005	mg/L	70	7	-	-	7	-	84
Lead	E239.2	0.005	mg/L	70	7	-	-	7	-	84
Mercury	E245.1	0.001	mg/L	70	7	-	-	7	-	84
Selenium	E270.2	0.005	mg/L	70	7	-	-	7	-	84
Petroleum Hydrocarbons	E418.1	1	mg/L	106	11	-	-	11	-	128
Petroleum Halocarbons	E601	(e)	ug/L	66	7	7	7	7	47	141
Acidity	E305.1	10	mg/L	4	1	-	-	1	-	6
Extractable Priority Pollutant	E625	(f)	ug/L	56	6	-	6	6	-	74
Purgeable Aromatics	SW5030/ SW8020	(g)	ug/L	106	11	11	11	11	75	225

ANNEX A

Table A-5

Analytical Methods, Detection Limits, and TOTAL Number of Analyses

PARAMETER	ANALYTICAL METHOD (a)	DETECTION LIMIT (b)	REPORTING UNITS (j)	NUMBER OF ANALYSES	DUP/REP	AMB COND BLANKS	TRIP BLANKS	SECOND COLUMN	TOTAL ANALYSES
[SOIL SAMPLES]									
Petroleum Hydrocarbons	SW3550/ E418.1	50	mg/kg	84	9	-	-	-	93
Metal Screen (23 metals)	SW3050/ SW6010	(d)	mg/kg	57	5	-	-	-	62
Arsenic	SW3050/ SW7060	0.5	mg/kg	57	5	-	-	-	62
Mercury	SW7471	0.5	mg/kg	57	5	-	-	-	62
Selenium	SW3050/ SW7740	1	mg/kg	57	5	-	-	-	62
Volatile Organic Compounds	SW5030/ SW8240	(h)	mg/kg	89	9	-	9	-	109
Semivolatile Organic Compounds	SW3550/ SW8270	(f)	mg/kg	39	3	-	-	-	39
EP Toxicity	40CFR 261.24	(i)	mg/Kg	4	1				5
Soil Moisture Content	ASTM D2216	-	per cent	89	9	-	-	-	98

NOTES

a The methods cited are from the following sources:

"A" Methods — Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985)

"E" Methods — Methods for Chemical Analysis of Water and Wastes, EPA Manuals, 600/4-79-020 (USEPA, 1983 - with additions)

Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, 40 CFR 136, Appendix A

Inductively Coupled Plasma - Atomic Emission Spectrometer Method for Trace Elements Analysis of Water and Wastes, 40 CFR 136, Appendix C

"SW" Methods — Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (USEPA, 1986)

b Contractor shall comply with the established criteria for Limits of Detection in Annex B.

c For soil/sediment samples, report results as mg/kg of dry soil or sediment. Report moisture content for each sample.

d Metals in water and soil/sediment samples. Limits of Detection must be at or below the values specified. (E200.7, SW6010)

Metal		Detection Limits Water (mg/L)	Soil/Sediment (mg/kg)
Aluminum	Al	0.2	20
Antimony	Sb	0.2	20
Arsenic	As	0.3	-
Barium	Ba	0.01	1
Beryllium	Be	0.002	0.2
Boron	B	0.03	3
Cadmium	Cd	0.005	2
Calcium	Ca	0.05	5
Chromium	Cr	0.03	4
Cobalt	Co	0.04	4
Copper	Cu	0.03	3
Iron	Fe	0.04	4
Lead	Pb	0.2	20
Magnesium	Mg	0.2	20
Manganese	Mn	0.01	1
Molybdenum	Mo	0.04	4
Nickel	Ni	0.015	5
Potassium	K	(determine at time of analysis)	
Selenium	Se	0.4	-

Silica	-	0.3	30
Silver	Ag	0.03	4
Sodium	Na	0.9	90
Thallium	Tl	0.2	20
Vanadium	V	0.04	4
Zinc	Zn	0.01	1

e Purgeable halocarbons in water and soil/sediment samples. Limits of Detection must be at or below the values specified. (E601, SW8010)

Parameter	Detection Limits Water (µg/L)	Soil/Sediment (mg/kg)
Bromodichloromethane	0.5	0.1
Bromoform	1	0.1
Bromomethane	6	0.1
Carbon tetrachloride	0.6	0.1
Chlorobenzene	1.2	0.1
Chloroethane	3	0.1
2-Chloroethylvinyl ether	0.7	0.1
Chloroform	0.2	0.1
Chloromethane	0.4	0.1
Dibromochloromethane	0.5	0.1
1,2-Dichlorobenzene	0.5	0.1
1,3-Dichlorobenzene	1	0.1
1,4-Dichlorobenzene	0.5	0.1
Dichlorodifluoromethane	9	0.1
1,1-Dichloroethane	0.4	0.1
1,2-Dichloroethane	0.2	0.1
1,1-Dichloroethene	0.7	0.1
trans-1,2-Dichloroethene	0.5	0.1
1,2-Dichloropropane	0.2	0.1
cis-1,3-Dichloropropene	1	0.1
trans-1,3-Dichloropropene	2	0.1
Methylene chloride	2	0.1
1,1,2,2-Tetrachloroethane	0.2	0.1
Trichloroethene	0.2	0.1
1,1,1-Trichloroethane	0.2	0.1
1,1,2-Trichloroethane	0.1	0.1
Tetrachloroethene	0.6	0.1
Trichlorofluoromethane	5	0.1
Vinyl chloride	0.2	0.1
Benzyl chloride	-	0.1
Bromobenzene	-	0.1
Bis(2-chloroethoxy)methane	-	0.1
Bis(2-chloroisopropyl)ether	-	0.1
Chloroacetaldehyde	-	0.1
Chloral	-	0.1
1-Chlorohexane	-	0.1
Chloromethyl methyl ether	-	0.1
2-Chlorotoluene	-	0.1
Dibromomethane	-	0.1

1,1,1,2-Tetrachloroethane	-	0.1
1,2,3-Trichloropropane	-	0.1

f Semivolatile organic compounds in water and soil/sediment samples. Limits of Detection must be at or below the values specified. (E625, SW8270)

Analyte (Base/neutral & acid extractables)	Detection Limits Water (µg/L)	Soil/Sediment (mg/kg)
Acenaphthene	10	0.5
Acenaphthylene	10	0.5
Anthracene	10	0.5
Benzo(a)anthracene	10	0.5
Benzo(b)fluoranthene	10	0.5
Benzo(k)fluoranthene	10	0.5
Benzo(a)pyrene	10	0.5
Benzo(ghi)perylene	10	0.5
Benzyl butyl phthalate	10	0.5
4-Bromophenyl phenyl ether	10	0.5
bis(2-Chloroethoxy)methane	10	0.5
bis(2-Chloroethyl) ether	10	0.5
bis(2-Chloroisopropyl) ether	10	0.5
2-Chloronaphthalene	10	0.5
4-Chlorophenyl phenyl ether	10	0.5
Chrysene	10	0.5
Dibenzo(a,h)anthracene	10	0.5
Di-n-butylphthalate	10	0.5
1,2-Dichlorobenzene	5	0.5
1,3-Dichlorobenzene	5	0.5
1,4-Dichlorobenzene	5	0.5
3,3'-Dichlorobenzidine	20	0.5
Diethyl phthalate	20	0.5
Dimethyl phthalate	10	0.5
2,4-Dinitrotoluene	10	0.5
2,6-Dinitrotoluene	10	0.5
Di-n-octyl phthalate	10	0.5
bis(2-ethylhexyl)phthalate	10	0.5
Fluoranthene	10	0.5
Fluorene	10	0.5
Hexachlorobenzene	10	0.5
Hexachlorobutadiene	10	0.5
Hexachloroethane	10	0.5
Indeno(1,2,3-cd)pyrene	10	0.5
Isophorone	10	0.5
Naphthalene	10	0.5
Nitrobenzene	10	0.5
n-Nitrosodi-n-propylamine	10	0.5
Phenanthrene	10	0.5
Pyrene	10	0.5
1,2,4-Trichlorobenzene	10	0.5

4-Chloro-3-methylphenol	10	0.5
2-Chlorophenol	10	0.5
2,4-Dichlorophenol	10	0.5
2,4-Dimethylphenol	10	0.5
2,4-Dinitrophenol	50	1.5
2-Methyl-4,6-dinitrophenol	50	1.5
2-Nitrophenol	10	0.5
4-Nitrophenol	10	0.5
Pentachlorophenol	10	0.5
Phenol	10	0.5
2,4,5-Trichlorophenol	50	1.5
2,4,6-Trichlorophenol	10	0.5

g Purgeable aromatic compounds in water and soil/sediment samples. Limits of Detection must be at or below the values specified. (E602, SW8020)

Analyte	Detection Limits Water (µg/L)	Soil/Sediment (mg/kg)
Benzene	0.7	0.2
Chlorobenzene	1	0.2
1,2-Dichlorobenzene	2	0.2
1,3-Dichlorobenzene	2	0.2
1,4-Dichlorobenzene	0.5	0.2
Ethylbenzene	1	0.2
Toluene	1	0.2
Xylenes	2	0.2

h Volatile organic compounds (VOCs) in water and soil/sediment samples. Limits of Detection must be at or below the values specified. (E624, SW8240)

Analyte	Detection Limits Water (ug/L)	Soil/Sediment (mg/kg)
Acetone	10	0.1
Benzene	3	0.1
Bromodichloromethane	5	0.1
Bromoform	5	0.1
Bromomethane	10	0.1
2-Butanone (MEK)	10	0.1
Carbon disulfide	5	0.1
Carbon tetrachloride	3	0.1
Chlorobenzene	5	0.1
Chloroethane	10	0.1
2-Chloroethylvinyl ether	10	0.1
Chloroform	5	0.1
Chloromethane	10	0.1
Dibromochloromethane	5	0.1
1,2-Dichlorobenzene	5	0.1
1,3-Dichlorobenzene	5	0.1

1,4-Dichlorobenzene	5	0.1
1,1-Dichloroethane	5	0.1
1,2-Dichloroethane	3	0.1
1,1-Dichloroethene	3	0.1
trans-1,2-Dichloroethene	5	0.1
1,2-Dichloropropane	5	0.1
cis-1,3-Dichloropropene	5	0.1
trans-1,3-Dichloropropene	5	0.1
Diethyl ether	10	0.1
Ethylbenzene	5	0.1
Methylene chloride	5	0.1
2-Methyl-2-pentanone (MIBK)	10	0.1
1,1,2,2-tetrachloroethane	5	0.1
Tetrachloroethene	3	0.1
Toluene	5	0.1
1,1,1-Trichloroethane	5	0.1
1,1,2-Trichloroethane	5	0.1
Trichloroethene	3	0.1
Trichlorofluoromethane	10	0.1
Vinyl chloride	0.5	0.1
Xylenes (total, all isomers)	5	0.1

i Detection Limits and Regulatory Limits for EP TOX

Metal	Detection Limits (mg/L)	40 CFR 261.24 Max Concentration
As	0.5	5.0
Ba	0.5	100
Cd	0.1	1.0
Cr	0.5	5.0
Pb	0.5	5.0
Hg	0.002	0.2
Se	0.1	1.0
Ag	0.5	5.0

Annex B

SPECIFIC REQUIREMENTS FOR CHEMICAL ANALYSES

B.1 **Analytical parameters.** The analytical parameters are summarized in Annex A along with the required methods.

B.2 **Limits of Detection.** Definition: the minimum concentration of a substance that can be measured and reported with 99% confidence that the true value is greater than zero. Analytical laboratories shall establish a Limit of Detection (LOD) for each parameter and analyte listed in Annex A using procedures outlined in one of the following references:

a. the applicable EPA or Standard method,

b. 40 Code of Federal Regulations (CFR) 136, Appendix B, or,

c. "Principles of Environmental Analysis" (Analytical Chemistry, Vol 55, pages 2210 - 2218, Dec 1983).

B.2.1 **Approval of Limits of Detection.** A list of the laboratory established Limits of Detection shall be incorporated into a table and included in the contractor's Quality Assurance Project Plan (QAPP). Limits of Detection must be approved by the USAFOEHL/TS Technical Program Manager prior to samples being submitted to the laboratory for analysis.

B.2.2 **Approval criteria.** Limits of Detection exceeding any one of the following criteria will not be approved:

a. LOD greater than the established Federal or state standard/criterion

b. LOD greater than the "Detection Limit" listed in Annex A of this delivery order

B.2.3 **Interference with detection of analyte in samples.** If the approved LOD for a particular analyte/parameter cannot be met because of matrix and/or other interferences, the laboratory shall report the detection limit actually achieved and explain in a footnote on the test report the difficulties encountered.

B.3 **Second-column GC confirmation.** For those methods which employ gas chromatography (GC) as the analytical technique (E601, E608, SW8020, SW8080, and SW8150) positive confirmation of identity is required for all analytes having concentrations higher than the Limit of Detection (LOD). Conduct positive confirmations by second-column GC; however, gas chromatography/mass spectroscopy (GC/MS) can be used for positive confirmation if the quantity of each analyte to be confirmed is above the detection level of the GC/MS instrument. Analytes which cannot be confirmed will be reported as "Not Detected" in the body of the report, but the second-column GC or GC/MS analytical results (numerical and nonnumerical) shall be provided in the report appendix along with the results of the first column analysis. Base the

quantification of confirmed analytes on the first-column analysis. The maximum number of second-column confirmational analyses shall not exceed fifty percent (50 %) of the actual number of field samples (to include duplicates, replicates, ambient conditions blanks, trip blanks, and equipment blanks). If the number of samples requiring second column confirmation exceeds this allowance, contact the USAFOEHL/TS Technical Program Manager. The total number of samples listed in Annex A includes the allowance applicable to each GC method. If GC/MS, or a combination of second-column GC and GC/MS, is used, the total cost of all such analyses for a particular parameter shall not exceed the funding allowed for positive confirmation using only second-column GC.

SPECIFIC FIELD REQUREMENTS

C.1 **FIELD SAMPLING, SAMPLE PRESERVATION AND HOLDING TIMES.** Strictly comply with the sampling techniques contained in Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985); ASTM, Section 11, Water and Environmental Technology; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (USEPA, 1986); Methods for Chemical analysis of Water and Wastes, EPA Manual 600/4-79-020 (1983); and the Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA Document 600/4-82-029 (1982). For water samples, follow the sample preservations and maximum holding times specified in 40 Code of Federal Regulations (CFR) 136.3 (e), Table II. Preservations and maximum holding times for all other sample matrices shall be in accordance with the applicable method.

C.2 **Sampling groundwater test wells.**

a. After development, allow wells to stabilize for a minimum of three (3) days before sampling. When possible, sample areas having low levels of contamination prior to sampling those having high levels. Record weather conditions prevalent at time of sampling (e.g., wind direction and speed, ambient temperature, precipitation). The Base Weather Service can be of assistance in supplying such information.

b. Prior to purging the wells, examine the surface of the water table for the presence of hydrocarbons and take water level measurements to the nearest 0.01 foot with respect to the established survey point on top of the well casing. If applicable, measure the thickness of the hydrocarbon layer. Record all observations and measurements and incorporate them into the Final Report (paragraph 1.9.1).

c. Purge the well using a submersible pump, bailer, or other acceptable method. Purge until a minimum of three (3) well volumes (based on borehole diameter) of water has been displaced and the pH, temperature, specific conductance, color, and odor of the discharge have stabilized using the following criteria: pH $\pm$ 0.1 unit, temperature $\pm$ 0.5C, and specific conductance $\pm$ 10 µmhos/cm. Include the final measurements in the Results section of the Final Report (paragraph 1.9.1).

d. Collect water samples with a Teflon bailer. To collect representative aquifer samples where floating hydrocarbons are present, use a "thief sampler" or similar point sampling device to minimize the influence of the free product.

e. If the well(s) cannot be sampled due to incomplete well development, unusual well characteristics, or other reason(s), indicate the reason(s) in the Final Report (paragraph 1.9.1).

f. Remeasure water levels after sampling and after the water conditions in the wells have stabilized. Record measurements in the field log.

C.3 **Collection of surface water/sediment samples.** Collect samples so as not to cause cross-contamination; obtain downstream samples first, and obtain the water sample at each location before the sediment sample. Measure pH, temperature, and specific conductance at each surface water sampling point. Permanently mark the location where surface water or sediment samples are collected. Record the location on a project map for each specific site or zone, whichever applies.

C.4 **Specific Requirements for Decontamination**

C.4.1 **Decontamination of sampling equipment.** Decontaminate all sampling equipment, including internal components, prior to use and between samples to avoid cross-contamination. Wash equipment with a laboratory-grade detergent followed by drinking quality water, ASTM Type II Reagent Water, pesticide-grade methanol, and pesticide-grade hexane rinses. Allow sufficient time for the solvent to evaporate and the equipment to dry completely before reuse. Sampling equipment used to collect samples for organics analysis shall not be allowed to come in contact with any type of plastic (e.g., plastic storage bags).

C.4.2 **Type II Reagent Water.** Insure that the Type II Reagent Water used to decontaminate sampling equipment is free of contaminants which may interfere with the required laboratory analyses. Type II Reagent Water is prepared using a still designed to produce a distillate having a conductivity of less than 1.0 micromho/cm (at 25 deg C). Double distillation and special features (e.g., degassing, activated charcoal filtration) are usually required to achieve the Type II Reagent Water specification. Distilled water purchased from local supply stores (e.g., supermarket) is not Type II Reagent Water. Furnish the analytical data or manufacturer's certification which verifies the quality of the Type II Reagent Water.

C.4.3 **Dedication of monofilament line.** Dedicate for each well the monofilament line or steel wire used to lower sampling equipment into the well. Do not use a line or wire in more than one well.

C.4.4 **Water level probe decontamination.** Decontaminate the calibrated water level probe for measuring well volume and water level elevation before use in each well.

C.4.5 **Drilling rig and tool decontamination.** Thoroughly clean and decontaminate the drilling rig and tools before initial use and after each borehole completion. As a minimum, steam clean drill bits after each borehole is installed. Drill from the "least" to the "most" contaminated sites, if possible.

C.4.6 **Well Security.** All wells shall be secured as soon as possible after drilling. Provide locks for both flush and above-ground well assemblies. Turn over the lock keys to the Base POC following completion of the field and sampling effort.

C.5 **Field quality assurance/quality control.** The following field quality assurance/quality control (QA/QC) samples are required:

a. One (1) trip blank with every batch of VOC samples (both soils and water) sent to the laboratory. Definition of trip blank: a sample bottle is filled with ASTM Type II Reagent Water, transported to the site, handled like a sample, and returned to the laboratory for analysis (trip blanks are not to be opened in the field). The trip blank for soils is Type II Reagent Water just as in the case of water samples.

b. One (1) ambient conditions blank per VOC sampling round (water) at a particular site or zone. Definition of Ambient Conditions Blank: Type II Reagent Water is poured into a sample container at the site, then is handled like a sample and transported to the laboratory for analysis.

c. One (1) set of equipment blanks for every day of groundwater sampling (all parameters analyzed). Definition of Equipment Blank: Type II Reagent water is poured into the sampling device, or pumped through it (in the case of sampling pumps), transferred to the sample bottle, and then transported to the laboratory for analysis.

d. Ten (10) percent field duplicates (all parameters analyzed) for water samples. Definition of Duplicate: two samples collected independently at a sampling location during a single act of sampling. Field duplicates shall be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are duplicates.

e. Ten (10) percent field replicates (all parameters analyzed) for soil/sediment samples. Definition of Replicate: a single sample (e.g., one bailer volume, one grab sample) is collected, then divided into two equal parts for the purpose of analysis. Replicate samples are often called "Splits." Field replicates shall be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are duplicates.

C.6 **Number of required samples.** Annex A specifies the maximum number of field QA/QC samples allowed for each analytical parameter.

C.7 **Chain-of-custody records.** Maintain chain-of-custody records for all field and QA/QC samples.

PART I SECTION F OF THE SCHEDULE
SUPPLIES SCHEDULE DATA

1. PROC INSTRUMENT ID NO. (PIIN): F33615-87-D-4018
2. SPIIN: 0002
3. PAGE 37 OF 38

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0001	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 89JUN30	A.	A. 1	U	FY7624	
B.	B.	B.			
C.	C.	C.			

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*
D.	D.	D.
E.	E.	E.

17. DESCRIPTIVE DATA

SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.
TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 88 SEP 30.

ALL DATA SHALL BE DELIVERED IAW ATTACHMENT #1 OF THE BASIC CONTRACT AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION NO LATER THAN 88 DEC 30.
THE DATA SHALL BE ACCEPTED BY THE GOVERNMENT NOT LATER THAN THE DATE SHOWN IN BLOCK 11A.

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0002	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 89JUN30	A.	A. 1	U	FY7624	
B.	B.	B.			
C.	C.	C.			

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*
D.	D.	D.
E.	E.	E.

17. DESCRIPTIVE DATA

SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.
TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 88 SEP 30.

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0003	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 89MAR23	A.	A. 1	U	FY7624	
B.	B.	B.			
C.	C.	C.			

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*
D.	D.	C.
E.	E.	E.

17. DESCRIPTIVE DATA

SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.

ALL COMPUTER SOFTWARE/DATA SHALL BE DELIVERED IAW ATTACHMENT #2 AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION NO LATER THAN 88 SEP 23.
THE DATA SHALL BE ACCEPTED BY THE GOVERNMENT NOT LATER THAN THE DATE SHOWN IN BLOCK 11A.

*REPRESENTS A NET INCREASE/DECREASE WHEN NO + OR – APPEARS AFTER THE ITEM NO.
E = ESTIMATED
– (IN QTY) = DECREASE
+ OR – (IN ITEM NO.) = ADDITION OR DELETION

PART I SECTION F OF THE SCHEDULE SUPPLIES SCHEDULE DATA	1. PROC INSTRUMENT ID NO. (PIIN) F33615-87-D-4018	2. SPIIN 0002	3. PAGE 38 OF 38

4. ITEM NO. 0004 | 5. ACRN AA | 6. TSP PRI | 7. MILSTRIP DOC NO. AND SUFFIX | 8. CON ITEM SERIAL NO. | 9. ENDING SERIAL NO. (WHEN APPL) | 10. CLIN IDENT EXHIBIT

11. DEL SCHED DATE A. 89JUN30 B. C. | 12. ENDING DATE (WHEN APPL) A. B. C. | 13. DEL SCHEDULE QTY* A. 1 B. C. | 14. SCTY CLAS U | 15. SHIP TO FY7624 | 16. MARK FOR

11. DEL SCHED DATE D. E. | 12. ENDING DATE (WHEN APPL) D. E. | 13. DEL SCHEDULE QTY* D. E.

17. DESCRIPTIVE DATA

SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.
TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 88 SEP 30.

ALL CHEMICAL ANALYSIS DATA SHALL BE DELIVERED IAW ATTACHMENT #1 AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION NO LATER THAN 88 DEC 30.
THE DATA SHALL BE ACCEPTED BY THE GOVERNMENT NOT LATER THAN THE DATE SHOWN IN BLOCK 11A.

4. ITEM NO. | 5. ACRN | 6. TSP PRI | 7. MILSTRIP DOC NO. AND SUFFIX | 8. CON ITEM SERIAL NO. | 9. ENDING SERIAL NO. (WHEN APPL) | 10. CLIN IDENT EXHIBIT

11. DEL SCHED DATE A. B. C. | 12. ENDING DATE (WHEN APPL) A. B. C. | 13. DEL SCHEDULE QTY* A. B. C. | 14. SCTY CLAS | 15. SHIP TO | 16. MARK FOR

11. DEL SCHED DATE D. E. | 12. ENDING DATE (WHEN APPL) D. E. | 13. DEL SCHEDULE QTY* D. E.

17. DESCRIPTIVE DATA

4. ITEM NO. | 5. ACRN | 6. TSP PRI | 7. MILSTRIP DOC NO. AND SUFFIX | 8. CON ITEM SERIAL NO. | 9. ENDING SERIAL NO. (WHEN APPL) | 10. CLIN IDENT EXHIBIT

11. DEL SCHED DATE A. B. C. | 12. ENDING DATE (WHEN APPL) A. B. C. | 13. DEL SCHEDULE QTY* A. B. C. | 14. SCTY CLAS | 15. SHIP TO | 16. MARK FOR

11. DEL SCHED DATE D. E. | 12. ENDING DATE (WHEN APPL) D. E. | 13. DEL SCHEDULE QTY* C. E.

17. DESCRIPTIVE DATA

*REPRESENTS A NET INCREASE/DECREASE WHEN NO + OR – APPEARS AFTER THE ITEM NO.
E = ESTIMATED
– (IN QTY) = DECREASE
+ OR – (IN ITEM NO.) = ADDITION OR DELETION

APPENDIX C

CLAYTON ENVIRONMENTAL CONSULTANTS' REPORT

4191B

Clayton Environmental Consultants

A Marsh & McLennan Company

Sampling and Analysis of Soils and Groundwater at Selfridge A.N.G.B.

Clayton Job No. 36041-19

TABLE OF CONTENTS

SAMPLING AND ANALYSIS
OF
SOILS AND GROUNDWATER
AT
SELFRIDGE A.N.G.B.
MT. CLEMONS, MICHIGAN

INTRODUCTION

The U.S. Army Corps of Engineers plans to construct a child development center on Selfridge Air National Guard Base (ANGB). The proposed location is north of Building 970 between Jefferson Avenue and Lake St. Clair.

The Office of the Air Surgeon recently examined the environmental conditions throughout the base and issued a report on a restoration program for the facility. This report indicates that south of Building 970 was the Tucker Creek Landfill. From 1930 to 1955, the landfill was used for the disposal of burned refuse, demolition materials, and residential and industrial wastes. Building 970 separates the actual landfill site from the site proposed for the child development center.

The purpose of the present study is to determine if environmental conditions at the site of the proposed child development center will threaten the health of the future users of the center. Soil and groundwater have been examined to determine if potentially dangerous contaminants are present.

In May, 1986, Clayton Environmental Consultants drilled and sampled at three locations around the proposed building site. Clayton issued a report that described the drilling, sampling, testing, and data analysis. A copy of the report, including test data, is attached to this report as Appendix A. At the time of the placement of the borings, the Air Surgeon's report was not available and no information was made available regarding the presence or location of the Tucker Creek Landfill and the larger disturbed area. After evaluating the Clayton report in conjunction with the Air Surgeon's report, the U.S. Army Corps of Engineers decided that a more extensive examination of environmental conditions was necessary. For that reason, the present study was undertaken.

Eight locations were drilled and sampled. Samples were taken at the surface and at depths of 2 feet, 5 feet and 10 feet. Monitor wells were placed in four of these locations after completion of the borings. Six of the borings, including three of the monitor wells, were placed in the disturbed area adjacent to the original landfill site.

Another boring was placed on the north side of the proposed construction area. The last boring was placed west of the proposed construction site across Jefferson Avenue. The Air Surgeon's report indicates that the groundwater in this area generally flows eastward toward Lake St. Clair. A monitor well was installed west of the site in the expectation that this location would be upgradient and would provide background information on groundwater entering the site.

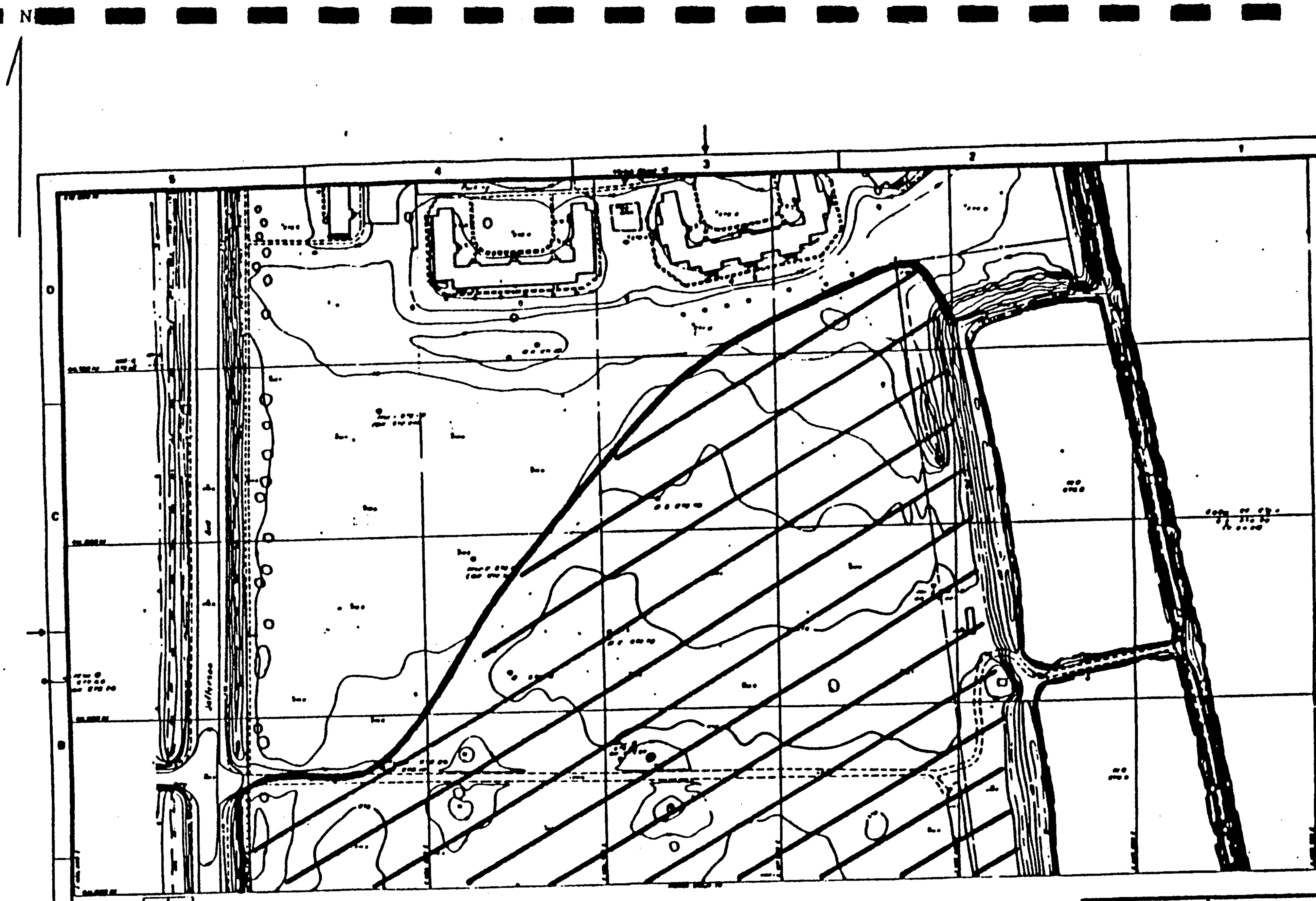


FIGURE 1

1 inch equals 185 feet

Extension of Tucker Creek Landfill

Monitor Well #3 was placed in the disturbed area adjacent to the fence on the east side of the site. This location is close to Lake St. Clair and was expected to provide information on groundwater flowing eastward and leaving the site. Locations of the boring and monitor wells are shown on Figure 2.

Monitor Wells 1 and 2 were placed during the drilling and sampling phase of the previous study by Clayton. Those wells have recently been resampled and the groundwater analyzed for the same constituents as those water samples taken during the present study.

The field crew intended to sample groundwater in the borings at the time of their completion before backfilling or well installation. Clayey soils with very low permeabilities were encountered and none of the borings recharged quickly enough to allow sampling of groundwater at the time of boring completion. Monitor Well #5 never recharged sufficiently for sampling a volume greater than that required for Volatile Organic Analysis and for explosives analysis. For this reason, no water from this well was analyzed for metals, base-neutral/acid compounds, total hydrocarbons, or pesticides and PCB's.

The borings were advanced using hollow-stem augers. Samples were taken from the boring at Monitor Well #4 using a 2" split spoon. Due to the large volume of sample required for all the analyses to be performed, 3" Shelby Tubes were used for sampling the remaining borings. The sample taken at 5 feet depth in the boring for Monitor Well 3 consisted of bricks and gravel and could not be analyzed as a soil sample.

Monitor wells were installed and the filter sand pack was placed through the hollow-stem auger flights. The wells were installed as shown in Figure 3. The drilling of the borings and installation of the monitor wells was observed by Mr. William Smithson of the U.S. Army Environmental Hygiene Agency.

GEOLOGY

Selfridge ANGB is located in Macomb County, Michigan on the shore of Lake St. Clair, and is approximately 2 miles east of Mt. Clemens, Michigan.

The geology at Selfridge ANGB is the result of glaciation and post-glacial depositional processes modified in recent years by human activity. Lacustrine and fluvial deposits cover the base. The soils are primarily clays and silts deposited since glacial times. The surficial deposits contain variable amounts of sand and gravel interspersed with occasional lenses of coarser granular material. There are surface sands at the southwest corner of the base. These surface sand deposits are probably a result of deposition from the Clinton River. The southern and southwestern portions of the base lie in the meander belt of the river. Fill material has been placed throughout the base during construction activities. A levee has been placed along lake St. Clair to prevent flooding due to changes in the lake level.

The glacial and post-glacial deposits are underlain by the Antrium Shale. The depth of this formation in the area of the Selfridge ANGB is from less than 100 to approximately 150 feet below ground surface. The Antrium Shale dips northeastward to form part of the Michigan Basin, a bowl shaped depression in the bedrock. The base lies over the southeastern slope of the basin.

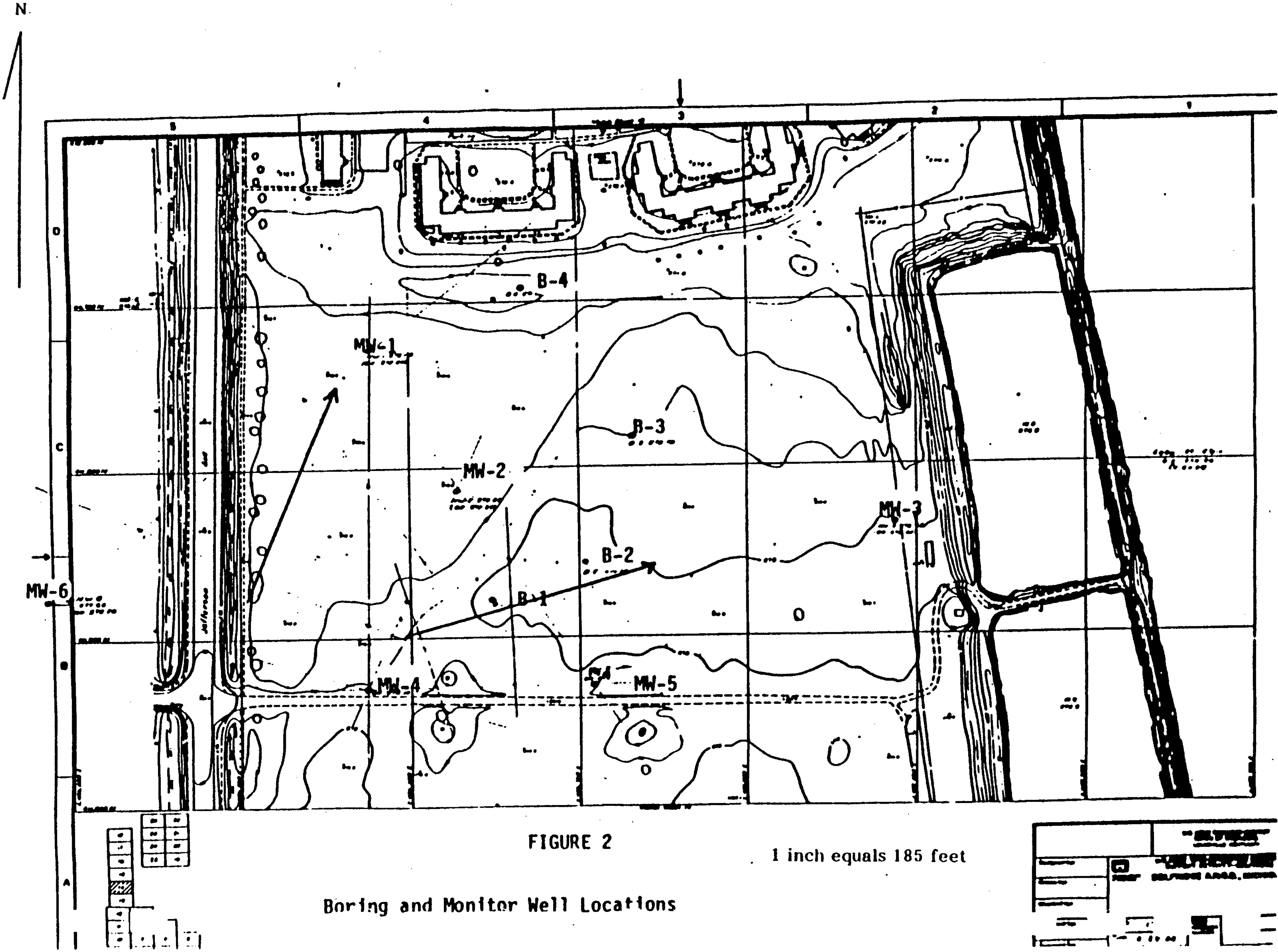


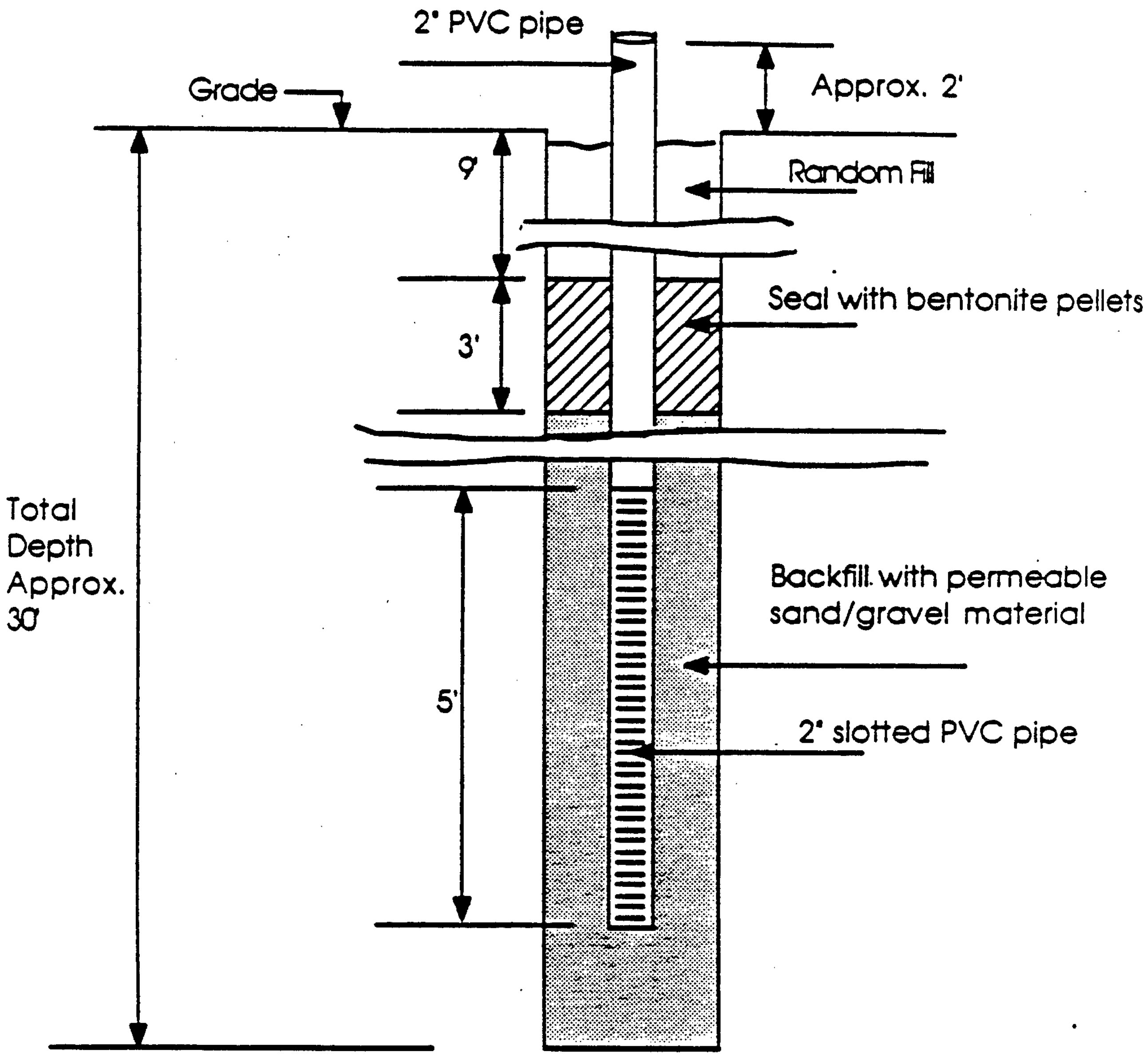
FIGURE 2

1 inch equals 185 feet

Boring and Monitor Well Locations

FIGURE 3

MONITOR WELL INSTALATION



Note: 5 feet of slotted PVC pipe and 26 feet of regular PVC pipe will be installed. Approx. 2 feet of pipe will remain above final grade at time of installation of monitor well.

HYDROLOGY

Groundwater resources are used for domestic water supplies but are insufficient for large scale use. Wells are installed into the glacial drift and intercept sand and gravel lenses of limited storage capacity. Ground water obtained from the underlying shale is highly mineralized, containing chlorides in excess of recommended limits.

There are shallow lenses of granular material on the base which produce water. The depth of the producing lenses ranges from 20 to 60 feet. Groundwater flow at the base is generally eastward toward lake St. Clair or southward toward the Clinton River. Local topography and past construction activities, however, affect local groundwater flows. Using potentiometic levels, we have constructed a general direction of groundwater flow (see Figure 2). This direction is based soley on water levels in the wells at the time of sample collection.

The lake level at the Lake St. Clair gaging station reached an all time high of 577.13 feet IGLD (1955) on October 4, 1986. While drilling operations were being conducted from October 8 through October 10, the daily mean lake elevation ranged from 576.81 to 576.93 feet. The elevation of the ground at the site ranges from approximately 571 to 575 feet.

Water elevations in the monitor wells were read on November 18, 1986. The readings are shown in Table 1. This information does not indicate a clear pattern of flow across the site, partially because of the high water levels in the lake. In addition, the site is crossed by several storm sewers. There are four drop inlets on the site. The storm sewers were probably installed by trenching, placing a sand bed, laying the pipe, and then backfilling with sand. This would provide a system that would drain the surface soils across the site. The drainage would be most pronounced in the vicinity of the sewers. Because of these factors, no conclusions can be drawn about the long term groundwater flow pattern on the site. To address the possibility of reversal of flow direction due to the lake level and of possible leaky sewers, we recommend that water levels in the wells be measured on a regular basis to determine the effects of lake levels and seasonal changes. We are not prepared to address the question of possible leaky sewers. This study did not include such an investigation. No water accumulated in the borings to facilitate water level measurements.

TABLE 1

Well	Depth to Water	Elevation of Well Casing	Groundwater Elevation
MW1	4.79'	575.18'	570.39'
MW2	3.46'	574.88'	571.42'
MW3	5.71'	576.63'	570.92'
MW4	12.98'	575.86'	562.88'
MW5	15.83'	575.84'	560.01'
MW6	14.46'	577.66'	563.20'

ANALYSIS FOR METALS

Soil and water samples were analyzed for the presence of metals from the U.S. EPA Primary Drinking Water Standards and for copper and zinc which are listed as drinking water metals by the State of Michigan. Monitor Well 5 did not produce enough water to allow analysis for metals. Results of the analyses are presented in Appendix C. Table 2 shows levels of metals that are commonly found naturally in surface soils in the vicinity of the site.

TABLE 2

Naturally Occurring Elemental Concentration

Metal	Concentration in ppm
Arsenic	10 - 16
Barium	700 - 1000
Cadmium	<1.0
Chromium	70 - 100
Copper	15 - 20
Lead	15 - 20
Mercury	.032 - .082
Selenium	.5 - .7
Silver	<1.0
Zinc	74 - 120

The information presented above is from "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States", by Hansford T. Shacklette and Josephine G. Boerngen, U.S. Geological Survey Professional Paper 1270, 1984.

All of the concentrations of metals found in the soil samples taken at the Selfridge site fall within or near the ranges listed. Because none of the samples contained metals in excess of what is expected to occur naturally, no soils were analyzed for EP toxic metals.

None of the water samples contained a concentration of metals in excess of the U.S. or State of Michigan Primary Drinking Water Standards.

CYANIDE, SULFIDE, AND TOTAL HYDROCARBON ANALYSES

Water samples from all monitoring wells except monitor Well 5 were tested for the presence of cyanide and sulfide. Soil and water samples were tested for total hydrocarbon content. None of these analytes were present in any sample in a quantity higher than the limit of detection. The results are presented in Appendix C.

BASE/NEUTRAL AND ACID COMPOUNDS

Water samples from all of the monitor wells except Monitor Well 5 were tested for the presence of the base and neutral-acid compounds from the list of priority pollutants. The results of the analyses are presented in Appendix D. None of the base-neutral or acid compounds were detected in quantity that would indicate the presence of contaminants in the groundwater. This analysis was run on groundwater samples from all monitor wells except MW-5.

PESTICIDE AND PCB ANALYSES

All soil samples and water samples from the monitor wells except for Monitor Well 5 were tested for the presence of pesticides and PCBs. Results are presented in Appendix E. Small amounts of pesticides were found in a sample taken 2 feet below the ground surface in boring B-2. Similar quantities were also found in a sample tested as a part of the previous Clayton study (Appendix A). Pesticides found were DDT and similar compounds.

VOLATILE ORGANIC ANALYSIS

Analysis of soil and water samples for Volatile Organic Compounds (Hazardous Substance List) was conducted by Gas Chromatography/Mass Spectrometry (GC/MS), using standard EPA Methodology (624). The results of both the initial (May, 1986) and subsequent (October, 1986) studies indicated the presense of very low concentrations of Methylene Chloride in a number of soil samples. Trichloroethene was reported between 9 - 14 ppb in six soils collected during the first study; no trichloroethene was indicated in the follow up survey and none was detected in groundwater samples.

While both of these compounds are generally considered synthetic, thus indicative of human activity, in our best judgement these reported trace quantities do not represent a significant environmental hazard and should not pose a risk unless additional information, currently unavailable to us, would point to the data as part of a more significant system. Our opinion is based on a variety of factors:

- Methylene Chloride is a common laboratory solvent, recognized by EPA as such, and accepted as an artifact up to 5 times the instrument detection level. The contractual protocol for reporting method blanks in the EPA Contract Lab Program is described in Figure 4. Under this protocol, Methylene Chloride and other common solvents, including Toluene (found at the detection limit in several samples) are accepted as lab contamination up to 5 times the Contract Required Detection Limit (CRDL). It is most probable, as indicated by the low consistent concentrations reported, that the Methylene Chloride reported is in the category of an artifact and should be disregarded.

- Trichloroethene, detected at only 2 times the detection limit in five soils from the first study and not found in the second study, is possibly an indication of minor drilling or sampling tool contamination limited to the first study. Solvent contamination is a difficult problem to overcome, despite every effort in the field to eliminate sources.

- Migration of the small concentrations of solvent reported, if present, from soil to the air has been demonstrated to be very slow. In addition, recent tests conducted by Dr. Paul Epstein of Clayton, show that Trichloroethene and Methylene Chloride are commonly detected in the air at concentrations of 2 - 4 ppb. Correlating this information leads to the conclusion that the soil gas migration at Selfridge would have little or no impact on the air quality in the area.

EXPLOSIVES ANALYSIS

Water samples from all monitor wells and composite soil samples from the borings and monitor wells were tested for the presence of three explosives: DNT, TNT, and RDX. These results are presented in Appendix G. The analyses were performed according to USATHAMA approved procedures. No explosives were detected in any of the samples tested.

CONCLUSIONS

There appears to be no chemical hazards present on the site which would affect the future use as the location of the proposed child development center. No indications have been found that the Tucker Creek Landfill extends onto the site. There is no evidence that groundwater is transporting hazardous materials to the proposed construction site.

FIGURE 4

SAMPLE MANAGEMENT OFFICE

Modification to

Contract Compliance Screening

Effective Date: September 1, 1986

Criterion: Method Blanks

Present Specification: Section C.2.e (Rev 5/86)

"A method blank must contain less than 5X the CRDL of the following common laboratory solvents: methylene chloride, acetone and toluene. (Ex. E, 3.2.1.1)"

Modified Specification: Section C.2.e (Rev 9/86)

"A method blank must contain less than 5X the CRDL of the following common laboratory solvents: methylene chloride, acetone and toluene. (Ex. E, 3.2.1.1) A method blank must also contain less than 5X the CRDL of 2-butanone."

APPENDIX A

SAMPLING AND ANALYSIS
OF
SOILS AND GROUNDWATER
AT
SELFRIDGE, ANGB
MT. CLEMENS, MICHIGAN
MAY, 1986

SAMPLING AND ANALYSIS OF SOILS AND GROUNDWATER AT SELFRIDGE, ANGB MT. CLEMENS, MICHIGAN MAY, 1986

Under contract to Cummins & Barnard, Inc. of Ann Arbor, Michigan, Clayton Environmental Consultants of Southfield, Michigan collected and analyzed soil and water samples from the property of Selfridge, ANGB in Mt. Clemens, Michigan. ~~The soil boring and sampling was conducted on May 21, 1986. Analytical work was completed on June 11, 1986.~~

Soil borings were made with a Type 550 drilling rig, equipped with a hollow stem auger and split spoon sampler. Three borings were made; two were used for soil and water sample collection. Soil samples were taken at 1 - 2 ft., 5 - 6 ft., and 9 - 10 ft. Boring logs are attached. The soil samples are labelled from top to bottom: sample B 1 - A was the first sample taken from boring B 1; B 1 - B was taken at the next depth.

An attempt was made to collect water from the borings. Neither of the wells recharged sufficiently on the first day to collect a sample. The site was revisited on the following day to attempt sample collection. The borings had filled with a small quantity of water, sufficient only for collection of samples for VOA's and selected metals.

The soil samples were analyzed for Priority Pollutants, both the inorganic and organic fractions. The water samples were analyzed for Safe Drinking Water Act metals and Volatile Organic Compounds. A summary of the analytical results is attached. All analyses were performed in accordance with approved EPA methodology and Clayton's Quality Assurance protocol was adhered to throughout the analytical process.

The only analytes which were detected at levels of significance were arsenic and methylene chloride. The arsenic concentrations which range from 15 to 25 ppm are slightly above the average concentrations determined by the U.S.G.S. (1) The average concentration for the area is 10 ppm and for the country is 5.2 ppm. Given this information, I don't feel the values obtained during this study are significant.

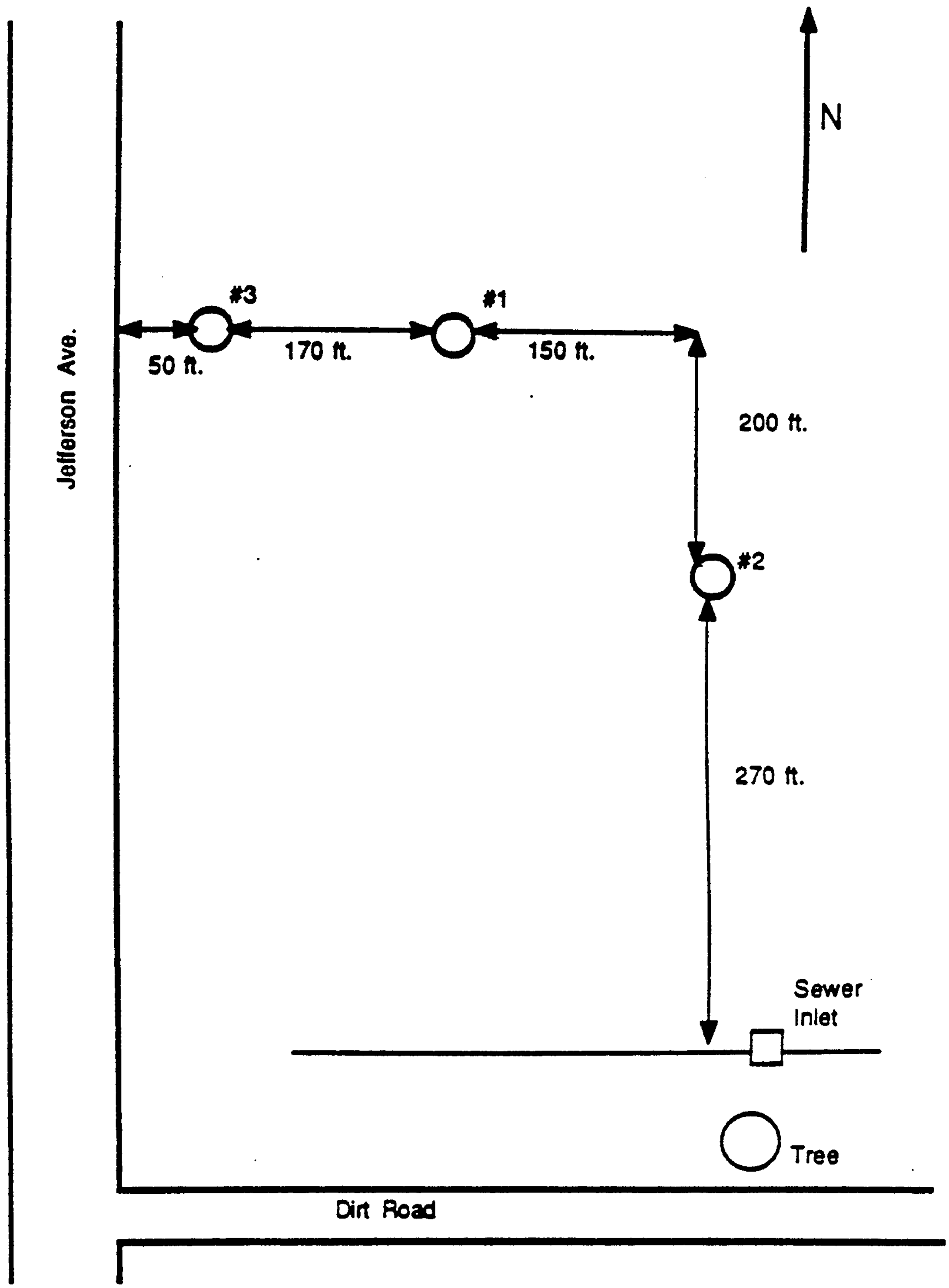
Methylene chloride is a common laboratory solvent and is frequently picked up on the walls of sample containers and by soils exposed to the lab atmosphere. Unless you have reason to suspect contamination of the site with this compound, I do not feel that these values (<100 ppb) represent a significant level of contamination.

(1) H.T.Shacklette and J.G.Boerngen, Element Concentrations in Soils and Other Surficial Materials of the Conterminous U.S.; U.S.G.S., 1984

SAMPLING LOCATIONS

SELFRIDGE, ANGB

MAY 21, 1986



STEARNS DRILLING

Industrial Park Drive
Dutton, Michigan 49511
616/698-7770

LOG OF TEST BORING NO. B-1

Sheet 1 of 1

Project Selfridge Field

Location Mt. Clemens, Michigan

Job No. 86-1345-5

Permit No.

BORING LOCATION

Surface Elev.

Date Started 05-21-86

Date Completed 05-21-86

Crew Chief Gryska

Drill Rig 550

Boring Method Hollow Auger

Hole plugged with Soil and Holeplug

Groundwater:

Encountered at ____ ft.

After Completion ____ ft.

After ____ hrs; ____ ft.

Volume

Seepage at ____ ft.

Boring Caved in at ____ ft.

LEGEND:

"N" - Standard Penetration Resistance
S.S. - 2" O.D. Split Spoon Sample
L.S. - Sectional Liner Sample
S.T. - Shelby Tube Sample
P - Pocket Penetrometer
S.N.R. - Sample Not Recovered

REMARKS:

Sample Type	REC	Blow Count	Depth in Feet	SOIL DESCRIPTION	Unified Soil Classif.
				Topsoil	
SS	12"	3 3 4		Brown and gray clay	
SS	18	3 6 6	5	Gray clay	
SS	18	2 2 1	10	Moist	

End of Boring at 10.0'

Well Data:

Installed 2" galvanized pipe with 2" x 60" stainless steel 10 slot screen set at 5.0' to 10.0', backfilled with silica sand.

Sealed with bentonite, concrete cap at ground surface.

Locking cap installed on pipe.

STEARNS DRILLING
Industrial Park Drive
Dutton, Michigan 49511
616/698-7770

LOG OF TEST BORING NO. B-2
Sheet 1 of 1
Project Selfridge Field

Location Mt. Clemens, Michigan

Job No. 86-1345-5
Permit No.

BORING LOCATION

Surface Elev.

Date Started 05-21-86
Date Completed 05-21-86

Crew Chief Gryska

Drill Rig 550
Boring Method Hollow Auger

Hole plugged with Soil and Holeplug

Groundwater:
Encountered at ____ ft.
After Completion ____ ft.
After ____ hrs; ____ ft.
Volume
Seepage at ____ ft.
Boring Caved in at ____ ft.

LEGEND:
"N" - Standard Penetration Resistance
S.S. - 2" O.D. Split Spoon Sample
L.S. - Sectional Liner Sample
S.T. - Shelby Tube Sample
P - Pocket Penetrometer
S.N.R. - Sample Not Recovered

REMARKS: Locking cap installed on pipe.

Sample Type	REC	Blow Count	Depth in Feet	SOIL DESCRIPTION	Uni S Classif.
				Topsoil	
SS	18	2 2 3		Brown and gray mottled clay	
SS	18	2 2 3	5		
SS	18	4 5 6	10		
		1 1 1	15		
				Gray sandy stiff clay	
		12 19 21	20	End of Boring at 20.0'	
				Well Data: Sealed and backfilled 20.0' boring. Moved over and augered to 10.0', installed 2" galvanized pipe with 2" x 60" stainless steel screen set at 5.0' to 10.0', backfilled with silica sand.	
			25	Sealed with bentonite.	
				Concrete cap at ground surface.	
			30		

STEARNS DRILLING

Industrial Park Drive
Dutton, Michigan 49511
616/698-7770

LOG OF TEST BORING NO. B-3

Sheet 1 of 1

Project Selfridge Field

Location Mt. Clemens, Michigan

Job No. 86-1345-5

Permit No.

BORING LOCATION

Surface Elev.

Date Started 05-21-86

Date Completed 05-21-86

Crew Chief Gryska

Drill Rig 550

Boring Method Hollow Auger

Hole plugged with Soil and Holeplug

Groundwater:

Encountered at ____ ft.

After Completion ____ ft.

After ____ hrs; ____ ft.

Volume

Seepage at ____ ft.

Boring Caved in at ____ ft.

LEGEND:

- "N" - Standard Penetration Resistance
- S.S. - 2" O.D.Split Spoon Sample
- L.S. - Sectional Liner Sample
- S.T. - Shelby Tube Sample
- P - Pocket Penetrometer
- S.N.R. - Sample Not Recovered

REMARKS:

Sample Type	REC	Blow Count	Depth in Feet	SOIL DESCRIPTION	Unified Soil Classif.
				Topsoil	
				Brown and gray clay	
SS	12"	3 3 5			
SS	18"	3 4 5	5		
				Gray clay	
SS	18"	2 2 2	10		
				End of Boring at 10.0'	
			15		
			20		
			25		
			30		

SUMMARY OF ANALYTICAL DATA - SELFRIDGE FIELD

SAMPLE LOCATION	MATRIX	Antimony	Arsenic	Beryllium	Barium	Cadmium	Copper	Chromium	Lead
B 1 - A	SOIL	<10	20	<0.05	N/A	<0.5	16	29	5
B 1 - B	SOIL	<10	15	<0.05	N/A	<0.5	15	30	8
B 1 - C	SOIL	<10	20	0.5	N/A	<0.5	22	36	8
B 2 - A	SOIL	<10	25	0.5	N/A	<0.5	24	32	6
B 2 - B	SOIL	<10	22	0.5	N/A	<0.5	21	31	9
B 2 - C	SOIL	<10	20	0.5	N/A	<0.5	25	39	8
S - 2	SOIL	<10	15	0.5	N/A	1	30	26	30
1 - 1	WATER	I/S	0.05	I/S	0.9	<0.005	0.12	0.4	0.08
2 - 1	WATER	I/S	<0.02	I/S	0.4	<0.005	<0.02	0.1	0.08

Soil results are reported as ug/g.
Water results are ereported as mg/l.

SUMMARY OF ANALYTICAL DATA - SELFRIDGE FIELD

SAMPLE LOCATION	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	Phenol	Cyanide
B 1 - A	<0.05	31	<1.0	<2.0	<10	52	64	<0.25
B 1 - B	<0.05	28	<1.0	<2.0	<10	40	<50	<0.25
B 1 - C	<0.05	35	<1.0	<2.0	<10	56	93	<0.25
B 2 - A	<0.05	44	<1.0	<2.0	<10	60	<50	<0.25
B 2 - B	<0.05	39	<1.0	<2.0	<10	58	<50	<0.25
B 2 - C	<0.05	40	<1.0	4	<10	68	<50	<0.25
S - 2	<0.05	31	<1.0	8	<10	72	58	<0.25
1 - 1	I/S	I/S	<0.01	<0.02	I/S	1.0	I/S	I/S
2 - 1	<0.001	I/S	<0.01	<0.02	I/S	1.5	I/S	I/S

Soil results are reported as ug/g.
Water results are ereported as mg/l.

PESTICIDES.PCB'S

CLIENT: CUMMINS AND SARNARD, INC.
Job Number: 33365-19
Sample Description: SOIL S1-A
LAB NUMBER: 466350

COMPOUND	CONCENTRATION (ug/kg)	L.O.D. (ug/kg)
alpha-BHC	N.D.	11.0
beta-BHC	N.D.	11.0
delta-BHC	N.D.	11.0
gamma-BHC (Lindane)	N.D.	11.0
Heptachlor	N.D.	11.0
Aldrin	N.D.	11.0
Heptachlor Epoxide	N.D.	11.0
Endosulfan I	N.D.	11.0
Dieldrin	N.D.	22.0
4,4'-DDE	N.D.	22.0
Endrin	N.D.	22.0
Endosulfan II	N.D.	22.0
4,4'-DDD	N.D.	22.0
Endosulfan Sulfate	N.D.	22.0
4,4'-DDT	N.D.	22.0
Endrin Ketone	N.D.	22.0
Methoxychlor	N.D.	110.0
Technical Chlordane	N.D.	110.0
Toxaphene	N.D.	220.0
A-1016	N.D.	110.0
A-1221	N.D.	110.0
A-1232	N.D.	110.0
A-1242	N.D.	110.0
A-1248	N.D.	110.0
A-1254	N.D.	110.0
A-1260	N.D.	220.0

L.O.D. = Limit of Detection

N.D. = Not Detected

J = Detected at a level at which quantitation would be uncertain

METHOD : EPA METHOD 608 (modified)

PESTICIDES/PCB'S

CLIENT: CUMMINS AND BARNARD, INC.
Job Number: 33368-19
Sample Description: SOIL B1-8
LAB NUMBER: 466351

COMPOUND	CONCENTRATION (ug/kg)	L.O.D. (ug/kg)
alpha-BHC	N.D.	11.0
beta-BHC	N.D.	11.0
delta-BHC	N.D.	11.0
gamma-BHC (Lindane)	N.D.	11.0
Heptachlor	N.D.	11.0
Aldrin	N.D.	11.0
Heptachlor Epoxide	N.D.	11.0
Endosulfan I	N.D.	11.0
Dieldrin	N.D.	22.0
4,4'-DDE	N.D.	22.0
Endrin	N.D.	22.0
Endosulfan II	N.D.	22.0
4,4'-DDD	N.D.	22.0
Endosulfan Sulfate	N.D.	22.0
4,4'-DDT	N.D.	22.0
Endrin Ketone	N.D.	22.0
Methoxychlor	N.D.	110.0
Technical Chlordane	N.D.	110.0
Toxaphene	N.D.	220.0
A-1016	N.D.	110.0
A-1221	N.D.	110.0
A-1232	N.D.	110.0
A-1242	N.D.	110.0
A-1248	N.D.	110.0
A-1254	N.D.	220.0
A-1260	N.D.	220.0

L.O.D. = Limit of Detection

N.D. = Not Detected
* Detected at a level at which quantitation would be uncertain
METHOD : EPA METHOD 608 (modified)

PESTICIDES/PCB'S

CLIENT: CUMMINS AND BARNARD, INC.
Job Number: 33355-13
Sample Description: SOIL B1-C
LAB NUMBER: 466352

COMPOUND	CONCENTRATION (ug/kg)	L.O.D. (ug/kg)
alpha-BHC	N.D.	11.0
beta-BHC	N.D.	11.0
delta-BHC	N.D.	11.0
gamma-BHC (Lindane)	N.D.	11.0
Heptachlor	N.D.	11.0
Aldrin	N.D.	11.0
Heptachlor Epoxide	N.D.	11.0
Endosulfan I	N.D.	11.0
Dieldrin	N.D.	22.0
4,4'-DDE	N.D.	22.0
Endrin	N.D.	22.0
Endosulfan II	N.D.	22.0
4,4'-DDD	N.D.	22.0
Endosulfan Sulfate	N.D.	22.0
4,4'-DDT	N.D.	22.0
Endrin Ketone	N.D.	22.0
Methoxychlor	N.D.	110.0
Technical Chlordane	N.D.	110.0
Toxaphene	N.D.	220.0
A-1016	N.D.	110.0
A-1221	N.D.	110.0
A-1232	N.D.	110.0
A-1242	N.D.	110.0
A-1248	N.D.	110.0
A-1254	N.D.	220.0
A-1260	N.D.	220.0

L.O.D. = Limit of Detection

N.D. = Not Detected
  * Detected at a level at which quantitation would
    be uncertain
METHOD : EPA METHOD 608 (modified)

PESTICIDES/PCB'S

CLIENT: CUMMINS AND BARNARD, INC.
Job Number: 33365-19
Sample Description: Laboratory soil blank
LAB NUMBER: Soil Blank

COMPOUND	CONCENTRATION (ug/kg)	L.O.D. (ug/kg)
alpha-BHC	N.D.	8.0
beta-BHC	N.D.	8.0
delta-BHC	N.D.	8.0
gamma-BHC (Lindane)	N.D.	8.0
Heptachlor	N.D.	8.0
Aldrin	N.D.	8.0
Heptachlor Epoxide	N.D.	8.0
Endosulfan I	N.D.	8.0
Dieldrin	N.D.	16.0
4,4'-DDE	N.D.	16.0
Endrin	N.D.	16.0
Endosulfan II	N.D.	16.0
4,4'-DDD	N.D.	16.0
Endosulfan Sulfate	N.D.	16.0
4,4'-DDT	N.D.	16.0
Endrin Ketone	N.D.	16.0
Methoxychlor	N.D.	80.0
Technical Chlordane	N.D.	80.0
Toxaphene	N.D.	160.0
A-1016	N.D.	80.0
A-1221	N.D.	80.0
A-1232	N.D.	80.0
A-1242	N.D.	80.0
A-1248	N.D.	80.0
A-1254	N.D.	160.0
A-1260	N.D.	160.0

L.O.D. = Limit of Detection

N.D. = Not Detected
. = Detected at a level at which quantitation would be uncertain
METHOD : EPA METHOD 608 (modified)

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466350
File No.: 83985
Sample Id.: 81-A

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	14
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	14
2-Chloroethylvinyl ether	ND	14
Chloroform	ND	7
Chloromethane	ND	14
Dibromochloromethane	ND	7
1,2-Dichlorobenzene	ND	7
1,3-Dichlorobenzene	ND	7
1,4-Dichlorobenzene	ND	7
1,1-Dichlorpethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	14
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
Methylene chloride	9	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	7	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	12	7
Trichlorofluoromethane	ND	7
Vinyl chloride	ND	14

ug/Kg - Results are reported on a dry weight basis

LOD = Limit of Detection   ND = Not Detected at LOD

* Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J173,1395

Clayton Environmental Consultants, Inc.

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466351
File No.: 83992
Sample Id.: 81-8

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	14
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	14
2-Chloroethylvinyl ether	ND	14
Chloroform	ND	7
Chloromethane	ND	14
Dibromochloromethane	ND	7
1,2-Dichlorobenzene	ND	7
1,3-Dichlorobenzene	ND	7
1,4-Dichlorobenzene	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	14
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
Methylene chloride	62	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	7	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	9	7
Trichlorofluoromethane	ND	7
Vinyl chloride	ND	14

ug/Kg - Results are reported on a dry weight basis

LOD = Limit of Detection ND = Not Detected at LOD

* Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J173,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466352
File No.: 83987
Sample Id.: B1-C

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	14
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	14
2-Chloroethylvinyl ether	ND	14
Chloroform	ND	7
Chloromethane	ND	14
Dibromochloromethane	ND	7
1,2-Dichlorobenzene	ND	7
1,3-Dichlorobenzene	ND	7
1,4-Dichlorobenzene	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	14
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
Methylene chloride	24	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	* 7	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	14	7
Trichlorofluoromethane	ND	7
Vinyl chloride	ND	14

ug/Kg - Results are reported on a dry weight basis

LOD = Limit of Detection   ND = Not Detected at LOD

* Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466353
File No.: 83958
Sample Id.: 82-A

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	13
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	13
2-Chloroethylvinyl ether	ND	13
Chloroform	ND	7
Chloromethane	ND	13
Dibromochloromethane	ND	7
1,2-Dichlorobenzene	ND	7
1,3-Dichlorobenzene	ND	7
1,4-Dichlorobenzene	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	13
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
Methylene chloride	24	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	11	7
Trichlorofluoromethane	ND	7
Vinyl chloride	ND	13

ug/kg - Results are reported on a dry weight basis

LOD = Limit of Detection   ND = Not Detected at LOD

* Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33385-19
Lab No.: 466354
File No.: 83989
Sample Id.: 82-8

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	14
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	14
2-Chloroethylvinyl ether	ND	14
Chloroform	ND	7
Chloromethane	ND	14
Dibromochloromethane	ND	7
1,2-Dichlorobenzene	ND	7
1,3-Dichlorobenzene	ND	7
1,4-Dichlorobenzene	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	14
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
Methylene chloride	70	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	7	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	12	7
Trichlorofluoromethane	ND	7
Vinyl chloride	ND	14

ug/kg - Results are reported on a dry weight basis

LOD = Limit of Detection ND = Not Detected at LOD

* Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33385-13
Lab No.: 486355
File No.: 83990
Sample Id.: 82-C

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/kg)
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	15
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	15
2-Chloroethylvinyl ether	ND	15
Chloroform	7	7
Chloromethane	ND	15
Dibromochloromethane	ND	7
1,2-Dichlorobenzene	ND	7
1,3-Dichlorobenzene	ND	7
1,4-Dichlorobenzene	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	15
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
Methylene chloride	93	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	7	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	12	7
Trichlorofluoromethane	ND	7
Vinyl chloride	ND	15

ug/Kg - Results are reported on a dry weight basis

LOD = Limit of Detection   ND = Not Detected at LOD

* Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466356
File No.: 83991
Sample Id.: S-2

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	14
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	14
2-Chloroethylvinyl ether	ND	14
Chloroform	* 7	7
Chloromethane	ND	14
Dibromochloromethane	ND	7
1,2-Dichlorobenzene	ND	7
1,3-Dichlorobenzene	ND	7
1,4-Dichlorobenzene	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	14
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
Methylene chloride	21	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	* 7	7
Toluene	* 7	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	9	7
Trichlorofluoromethane	ND	7
Vinyl chloride	ND	14

ug/Kg - Results are reported on a dry weight basis

LOD = Limit of Detection   ND = Not Detected at LOD

* Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J176,1985

Clayton Environmental Consultants, Inc.

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: ------
File No.: 83384
Sample Id.: LAB BLANK

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,2-Dichlorobenzene	ND	5
1,3-Dichlorobenzene	ND	5
1,4-Dichlorobenzene	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
Methylene chloride	5	5
1,1,2,2-Tetrachloroethane	5	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	5	5
Trichlorofluoromethane	ND	5
Vinyl chloride	ND	10

ug/Kg - Results are reported on a dry weight basis

LOD = Limit of Detection   ND = Not Detected at LOD

* = Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 468097
File No.: 83979
Sample Id.: 1-1

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,2-Dichlorobenzene	ND	5
1,3-Dichlorobenzene	ND	5
1,4-Dichlorobenzene	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
Methylene chloride	< 5	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Trichlorofluoromethane	ND	5
Vinyl chloride	ND	10

LOD = Limit of Detection   ND = Not Detected at LOD

< = Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 468099
File No.: 83980
Sample Id.: 2-1

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,2-Dichlorobenzene	ND	5
1,3-Dichlorobenzene	ND	5
1,4-Dichlorobenzene	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
Methylene chloride	< 5	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	< 5	5
Trichlorofluoromethane	< 5	5
Vinyl chloride	ND	10

LOD = Limit of Detection   ND = Not Detected at LOD

< = Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: ------
File No.: 83978
Sample Id.: LAB BLANK

Volatile Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,2-Dichlorobenzene	ND	5
1,3-Dichlorobenzene	ND	5
1,4-Dichlorobenzene	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
Methylene chloride	< 5	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	< 5	5
Trichlorofluoromethane	ND	5
Vinyl chloride	ND	10

LOD = Limit of Detection   ND = Not Detected at LOD

< = Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466350
File No.: A5164
Sample Id.: 81-A

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acenaphthene	ND	450
Acenaphthylene	ND	450
Anthracene	ND	450
Benzidine	ND	2300
Benzo(a)anthracene	ND	450
Benzo(b)fluoranthene	ND	450
Benzo(k)fluoranthene	ND	450
Benzo(a)pyrene	ND	450
Benzo(ghi)perylene	ND	450
Benzyl butyl phthalate	ND	450
Bis(2-chloroethyl)ether	ND	450
Bis(2-chloroethoxy)methane	ND	450
Bis(2-chloroisopropyl)ether	ND	450
Bis(2-ethylhexyl)phthalate	ND	450
4-Bromophenyl phenyl ether	ND	450
2-Chloronaphthalene	ND	450
4-Chlorophenyl phenyl ether	ND	450
Chrysene	ND	450
Dibenzo(a,h)anthracene	ND	450
Di-n-butylphthalate	ND	450
1,2-Dichlorobenzene	ND	450
1,3-Dichlorobenzene	ND	450
1,4-Dichlorobenzene	ND	450
3,3'-Dichlorobenzidine	ND	900
Diethyl phthalate	ND	450
Dimethyl phthalate	ND	450
2,4-Dinitrotoluene	ND	450
2,6-Dinitrotoluene	ND	450
Di-n-octylphthalate	ND	450
Fluoranthene	ND	450

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No: 33365-19
Lab No: 466350
File No: A5164
Sample Id.: 81-A

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Fluorene	ND	450
Hexachlorobenzene	ND	450
Hexachlorobutadiene	ND	450
Hexachlorocyclopentadiene	ND	450
Hexachloroethane	ND	450
Indeno(1,2,3-cd)pyrene	ND	450
Isophorone	ND	450
Naphthalene	ND	450
Nitrobenzene	ND	450
N-Nitrosodimethylamine	ND	450
N-Nitrosodi-n-propylamine	ND	450
N-Nitrosodiphenylamine	ND	450
Phenanthrene	ND	450
Pyrene	ND	450
1,2,4-Trichlorobenzene	ND	450

ug/Kg - Reports are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J179,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466350
File No.: A5164
Sample Id.: B1-A

Acid Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
4-Chloro-3-methylphenol	ND	450
2-Chlorophenol	ND	450
2,4-Dichlorophenol	ND	450
2,4-Dimethylphenol	ND	450
2,4-Dinitrophenol	ND	2300
2-Methyl-4,6-dinitrophenol	ND	2300
2-Nitrophenol	ND	450
4-Nitrophenol	ND	2300
Pentachlorophenol	ND	2300
Phenol	ND	450
2,4,6-Trichlorophenol	ND	450

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466351
File No.: A5165
Sample Id.: B1-B

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acenaphthene	ND	460
Acenaphthylene	ND	460
Anthracene	ND	460
Benzidine	ND	2300
Benzo(a)anthracene	ND	460
Benzo(b)fluoranthene	ND	460
Benzo(k)fluoranthene	ND	460
Benzo(a)pyrene	ND	460
Benzo(ghi)perylene	ND	460
Benzyl butyl phthalate	ND	460
Bis(2-chloroethyl)ether	ND	460
Bis(2-chloroethoxy)methane	ND	460
Bis(2-chloroisopropyl)ether	ND	460
Bis(2-ethylhexyl)phthalate	ND	460
4-Bromophenyl phenyl ether	ND	460
2-Chloronaphthalene	ND	460
4-Chlorophenyl phenyl ether	ND	460
Chrysene	ND	460
Dibenzo(a,h)anthracene	ND	460
Di-n-butylphthalate	ND	460
1,2-Dichlorobenzene	ND	460
1,3-Dichlorobenzene	ND	460
1,4-Dichlorobenzene	ND	460
3,3'-Dichlorobenzidine	ND	910
Diethyl phthalate	ND	460
Dimethyl phthalate	ND	460
2,4-Dinitrotoluene	ND	460
2,6-Dinitrotoluene	ND	460
Di-n-octylphthalate	ND	460
Fluoranthene	ND	460

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No: 33365-19
Lab No: 466351
File No: A5165
Sample Id.: B1-8

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Fluorene	ND	460
Hexachlorobenzene	ND	460
Hexachlorobutadiene	ND	460
Hexachlorocyclopentadiene	ND	460
Hexachloroethane	ND	460
Indeno(1,2,3-cd)pyrene	ND	460
Isophorone	ND	460
Naphthalene	ND	460
Nitrobenzene	ND	460
N-Nitrosodimethylamine	ND	460
N-Nitrosodi-n-propylamine	ND	460
N-Nitrosodiphenylamine	ND	460
Phenanthrene	ND	460
Pyrene	ND	460
1,2,4-Trichlorobenzene	ND	460

ug/Kg - Reports are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466351
File No.: A5165
Sample Id.: B1-8

Acid Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
4-Chloro-3-methylphenol	ND	460
2-Chlorophenol	ND	460
2,4-Dichlorophenol	ND	460
2,4-Dimethylphenol	ND	460
2,4-Dinitrophenol	ND	2300
2-Methyl-4,6-dinitrophenol	ND	2300
2-Nitrophenol	ND	460
4-Nitrophenol	ND	2300
Pentachlorophenol	ND	2300
Phenol	ND	460
2,4,6-Trichlorophenol	ND	460

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466352
File No.: A5166
Sample Id.: 81-C

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acenaphthene	ND	470
Acenaphthylene	ND	470
Anthracene	ND	470
Benzidine	ND	2300
Benzo(a)anthracene	ND	470
Benzo(b)fluoranthene	ND	470
Benzo(k)fluoranthene	ND	470
Benzo(a)pyrene	ND	470
Benzo(ghi)perylene	ND	470
Benzyl butyl phthalate	ND	470
Bis(2-chloroethyl)ether	ND	470
Bis(2-chloroethoxy)methane	ND	470
Bis(2-chloroisopropyl)ether	ND	470
Bis(2-ethylhexyl)phthalate	ND	470
4-Bromophenyl phenyl ether	ND	470
2-Chloronaphthalene	ND	470
4-Chlorophenyl phenyl ether	ND	470
Chrysene	ND	470
Dibenzo(a,h)anthracene	ND	470
Di-n-butylphthalate	ND	470
1,2-Dichlorobenzene	ND	470
1,3-Dichlorobenzene	ND	470
1,4-Dichlorobenzene	ND	470
3,3'-Dichlorobenzidine	ND	930
Diethyl phthalate	ND	470
Dimethyl phthalate	ND	470
2,4-Dinitrotoluene	ND	470
2,6-Dinitrotoluene	ND	470
Di-n-octylphthalate	ND	470
Fluoranthene	ND	470

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No: 33365-19
Lab No: 466352
File No: A5166
Sample Id.: 81-C

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Fluorene	ND	470
Hexachlorobenzene	ND	470
Hexachlorobutadiene	ND	470
Hexachlorocyclopentadiene	ND	470
Hexachloroethane	ND	470
Indeno(1,2,3-cd)pyrene	ND	470
Isophorone	ND	470
Naphthalene	ND	470
Nitrobenzene	ND	470
N-Nitrosodimethylamine	ND	470
N-Nitrosodi-n-propylamine	ND	470
N-Nitrosodiphenylamine	ND	470
Phenanthrene	ND	470
Pyrene	ND	470
1,2,4-Trichlorobenzene	ND	470

ug/Kg - Reports are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466352
File No.: A5166
Sample Id.: B1-C

Acid Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
4-Chloro-3-methylphenol	ND	470
2-Chlorophenol	ND	470
2,4-Dichlorophenol	ND	470
2,4-Dimethylphenol	ND	470
2,4-Dinitrophenol	ND	2300
2-Methyl-4,6-dinitrophenol	ND	2300
2-Nitrophenol	ND	470
4-Nitrophenol	ND	2300
Pentachlorophenol	ND	2300
Phenol	ND	470
2,4,6-Trichlorophenol	ND	470

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466353
File No.: A5167
Sample Id.: B2-A

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acenaphthene	ND	440
Acenaphthylene	ND	440
Anthracene	ND	440
Benzidine	ND	2200
Benzo(a)anthracene	ND	440
Benzo(b)fluoranthene	ND	440
Benzo(k)fluoranthene	ND	440
Benzo(a)pyrene	ND	440
Benzo(ghi)perylene	ND	440
Benzyl butyl phthalate	< 440	440
Bis(2-chloroethyl)ether	ND	440
Bis(2-chloroethoxy)methane	ND	440
Bis(2-chloroisopropyl)ether	ND	440
Bis(2-ethylhexyl)phthalate	ND	440
4-Bromophenyl phenyl ether	ND	440
2-Chloronaphthalene	ND	440
4-Chlorophenyl phenyl ether	ND	440
Chrysene	ND	440
Dibenzo(a,h)anthracene	ND	440
Di-n-butylphthalate	ND	440
1,2-Dichlorobenzene	ND	440
1,3-Dichlorobenzene	ND	440
1,4-Dichlorobenzene	ND	440
3,3'-Dichlorobenzidine	ND	880
Diethyl phthalate	ND	440
Dimethyl phthalate	ND	440
2,4-Dinitrotoluene	ND	440
2,6-Dinitrotoluene	ND	440
Di-n-octylphthalate	ND	440
Fluoranthene	ND	440

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No: 33365-19
Lab No: 466353
File No: A5167
Sample Id.: B2-A

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Fluorene	ND	440
Hexachlorobenzene	ND	440
Hexachlorobutadiene	ND	440
Hexachlorocyclopentadiene	ND	440
Hexachloroethane	ND	440
Indeno(1,2,3-cd)pyrene	ND	440
Isophorone	ND	440
Naphthalene	ND	440
Nitrobenzene	ND	440
N-Nitrosodimethylamine	ND	440
N-Nitrosodi-n-propylamine	ND	440
N-Nitrosodiphenylamine	ND	440
Phenanthrene	ND	440
Pyrene	ND	440
1,2,4-Trichlorobenzene	ND	440

ug/Kg - Reports are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

/ - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466353
File No.: A5167
Sample Id.: 82-A

Acid Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
4-Chloro-3-methylphenol	ND	440
2-Chlorophenol	ND	440
2,4-Dichlorophenol	ND	440
2,4-Dimethylphenol	ND	440
2,4-Dinitrophenol	ND	2200
2-Methyl-4,6-dinitrophenol	ND	2200
2-Nitrophenol	ND	440
4-Nitrophenol	ND	2200
Pentachlorophenol	ND	2200
Phenol	ND	440
2,4,6-Trichlorophenol	ND	440

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466354
File No.: A5171
Sample Id.: B2-8

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acenaphthene	ND	480
Acenaphthylene	ND	480
Anthracene	ND	480
Benzidine	ND	2400
Benzo(a)anthracene	ND	480
Benzo(b)fluoranthene	ND	480
Benzo(k)fluoranthene	ND	480
Benzo(a)pyrene	ND	480
Benzo(ghi)perylene	ND	480
Benzyl butyl phthalate	< 480	480
Bis(2-chloroethyl)ether	ND	480
Bis(2-chloroethoxy)methane	ND	480
Bis(2-chloroisopropyl)ether	ND	480
Bis(2-ethylhexyl)phthalate	ND	480
4-Bromophenyl phenyl ether	ND	480
2-Chloronaphthalene	ND	480
4-Chlorophenyl phenyl ether	ND	480
Chrysene	ND	480
Dibenzo(a,h)anthracene	ND	480
Di-n-butylphthalate	ND	480
1,2-Dichlorobenzene	ND	480
1,3-Dichlorobenzene	ND	480
1,4-Dichlorobenzene	ND	480
3,3'-Dichlorobenzidine	ND	950
Diethyl phthalate	< 480	480
Dimethyl phthalate	ND	480
2,4-Dinitrotoluene	ND	480
2,6-Dinitrotoluene	ND	480
Di-n-octylphthalate	ND	480
Fluoranthene	ND	480

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No: 33365-19
Lab No: 466354
File No: A5171
Sample Id.: B2-8

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Fluorene	ND	480
Hexachlorobenzene	ND	480
Hexachlorobutadiene	ND	480
Hexachlorocyclopentadiene	ND	480
Hexachloroethane	ND	480
Indeno(1,2,3-cd)pyrene	ND	480
Isophorone	ND	480
Naphthalene	ND	480
Nitrobenzene	ND	480
N-Nitrosodimethylamine	ND	480
N-Nitrosodi-n-propylamine	ND	480
N-Nitrosodiphenylamine	ND	480
Phenanthrene	ND	480
Pyrene	ND	480
1,2,4-Trichlorobenzene	ND	480

ug/Kg - Reports are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466354
File No.: A5171
Sample Id.: 82-8

Acid Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
4-Chloro-3-methylphenol	ND	480
2-Chlorophenol	ND	480
2,4-Dichlorophenol	ND	480
2,4-Dimethylphenol	ND	480
2,4-Dinitrophenol	ND	2400
2-Methyl-4,6-dinitrophenol	ND	2400
2-Nitrophenol	ND	480
4-Nitrophenol	ND	2400
Pentachlorophenol	ND	2400
Phenol	ND	480
2,4,6-Trichlorophenol	ND	480

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466355
File No.: A5172
Sample Id.: B2-C

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acenaphthene	ND	490
Acenaphthylene	ND	490
Anthracene	ND	490
Benzidine	ND	2400
Benzo(a)anthracene	ND	490
Benzo(b)fluoranthene	ND	490
Benzo(k)fluoranthene	ND	490
Benzo(a)pyrene	ND	490
Benzo(ghi)perylene	ND	490
Benzyl butyl phthalate	ND	490
Bis(2-chloroethyl)ether	ND	490
Bis(2-chloroethoxy)methane	ND	490
Bis(2-chloroisopropyl)ether	ND	490
Bis(2-ethylhexyl)phthalate	ND	490
4-Bromophenyl phenyl ether	ND	490
2-Chloronaphthalene	ND	490
4-Chlorophenyl phenyl ether	ND	490
Chrysene	ND	490
Dibenzo(a,h)anthracene	ND	490
Di-n-butylphthalate	ND	490
1,2-Dichlorobenzene	ND	490
1,3-Dichlorobenzene	ND	490
1,4-Dichlorobenzene	ND	490
3,3'-Dichlorobenzidine	ND	980
Diethyl phthalate	ND	490
Dimethyl phthalate	ND	490
2,4-Dinitrotoluene	ND	490
2,6-Dinitrotoluene	ND	490
Di-n-octylphthalate	ND	490
Fluoranthene	ND	490

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No: 33365-19
Lab No: 466355
File No: A5172
Sample Id.: 82-C

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Fluorene	ND	490
Hexachlorobenzene	ND	490
Hexachlorobutadiene	ND	490
Hexachlorocyclopentadiene	ND	490
Hexachloroethane	ND	490
Indeno(1,2,3-cd)pyrene	ND	490
Isophorone	ND	490
Naphthalene	ND	490
Nitrobenzene	ND	490
N-Nitrosodimethylamine	ND	490
N-Nitrosodi-n-propylamine	ND	490
N-Nitrosodiphenylamine	ND	490
Phenanthrene	ND	490
Pyrene	ND	490
1,2,4-Trichlorobenzene	ND	490

ug/Kg - Reports are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466355
File No.: A5172
Sample Id.: 82-C

Acid Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
4-Chloro-3-methylphenol	ND	490
2-Chlorophenol	ND	490
2,4-Dichlorophenol	ND	490
2,4-Dimethylphenol	ND	490
2,4-Dinitrophenol	ND	2400
2-Methyl-4,6-dinitrophenol	ND	2400
2-Nitrophenol	ND	490
4-Nitrophenol	ND	2400
Pentachlorophenol	ND	2400
Phenol	ND	490
2,4,6-Trichlorophenol	ND	490

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466356
File No.: A5173
Sample Id.: S-2

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acenaphthene	ND	470
Acenaphthylene	ND	470
Anthracene	ND	470
Benzidine	ND	2400
Benzo(a)anthracene	ND	470
Benzo(b)fluoranthene	ND	470
Benzo(k)fluoranthene	ND	470
Benzo(a)pyrene	ND	470
Benzo(ghi)perylene	ND	470
Benzyl butyl phthalate	ND	470
Bis(2-chloroethyl)ether	ND	470
Bis(2-chloroethoxy)methane	ND	470
Bis(2-chloroisopropyl)ether	ND	470
Bis(2-ethylhexyl)phthalate	ND	470
4-Bromophenyl phenyl ether	ND	470
2-Chloronaphthalene	ND	470
4-Chlorophenyl phenyl ether	ND	470
Chrysene	ND	470
Dibenzo(a,h)anthracene	ND	470
Di-n-butylphthalate	ND	470
1,2-Dichlorobenzene	ND	470
1,3-Dichlorobenzene	ND	470
1,4-Dichlorobenzene	ND	470
3,3'-Dichlorobenzidine	ND	950
Diethyl phthalate	ND	470
Dimethyl phthalate	ND	470
2,4-Dinitrotoluene	ND	470
2,6-Dinitrotoluene	ND	470
Di-n-octylphthalate	ND	470
Fluoranthene	< 470	470

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No: 33365-19
Lab No: 466356
File No: A5173
Sample Id.: S-2

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Fluorene	ND	470
Hexachlorobenzene	ND	470
Hexachlorobutadiene	ND	470
Hexachlorocyclopentadiene	ND	470
Hexachloroethane	ND	470
Indeno(1,2,3-cd)pyrene	ND	470
Isophorone	ND	470
Naphthalene	ND	470
Nitrobenzene	ND	470
N-Nitrosodimethylamine	ND	470
N-Nitrosodi-n-propylamine	ND	470
N-Nitrosodiphenylamine	ND	470
Phenanthrene	ND	470
Pyrene	< 470	470
1,2,4-Trichlorobenzene	ND	470

ug/Kg - Reports are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: 466356
File No.: A5173
Sample Id.: S-2

Acid Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
4-Chloro-3-methylphenol	ND	470
2-Chlorophenol	ND	470
2,4-Dichlorophenol	ND	470
2,4-Dimethylphenol	ND	470
2,4-Dinitrophenol	ND	2400
2-Methyl-4,6-dinitrophenol	ND	2400
2-Nitrophenol	ND	470
4-Nitrophenol	ND	2400
Pentachlorophenol	ND	2400
Phenol	ND	470
2,4,6-Trichlorophenol	ND	470

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

✓ - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: ------
File No.: A5163
Sample Id.: LAB BLANK

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acenaphthene	ND	330
Acenaphthylene	ND	330
Anthracene	ND	330
Benzidine	ND	1700
Benzo(a)anthracene	ND	330
Benzo(b)fluoranthene	ND	330
Benzo(k)fluoranthene	ND	330
Benzo(a)pyrene	ND	330
Benzo(ghi)perylene	ND	330
Benzyl butyl phthalate	ND	330
Bis(2-chloroethyl)ether	ND	330
Bis(2-chloroethoxy)methane	ND	330
Bis(2-chloroisopropyl)ether	ND	330
Bis(2-ethylhexyl)phthalate	< 330	330
4-Bromophenyl phenyl ether	ND	330
2-Chloronaphthalene	ND	330
4-Chlorophenyl phenyl ether	ND	330
Chrysene	ND	330
Dibenzo(a,h)anthracene	ND	330
Di-n-butylphthalate	ND	330
1,2-Dichlorobenzene	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
3,3'-Dichlorobenzidine	ND	670
Diethyl phthalate	< 330	330
Dimethyl phthalate	ND	330
2,4-Dinitrotoluene	ND	330
2,6-Dinitrotoluene	ND	330
Di-n-octylphthalate	ND	330
Fluoranthene	ND	330

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No: 33365-19
Lab No: ------
File No: A5163
Sample Id.: LAB BLANK

Base Neutral Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Fluorene	ND	330
Hexachlorobenzene	ND	330
Hexachlorobutadiene	ND	330
Hexachlorocyclopentadiene	ND	330
Hexachloroethane	ND	330
Indeno(1,2,3-cd)pyrene	ND	330
Isophorone	ND	330
Naphthalene	ND	330
Nitrobenzene	ND	330
N-Nitrosodimethylamine	ND	330
N-Nitrosodi-n-propylamine	ND	330
N-Nitrosodiphenylamine	ND	330
Phenanthrene	ND	330
Pyrene	ND	330
1,2,4-Trichlorobenzene	ND	330

ug/Kg - Reports are reported on a dry weight basis

LOD - Limit of Detection

ND - Not Detected at LOD

- Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

CEC Job No.: 33365-19
Lab No.: ------
File No.: A5163
Sample Id.: LAB BLANK

Acid Compounds - Priority Pollutants

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
4-Chloro-3-methylphenol	ND	330
2-Chlorophenol	ND	330
2,4-Dichlorophenol	ND	330
2,4-Dimethylphenol	ND	330
2,4-Dinitrophenol	ND	1700
2-Methyl-4,6-dinitrophenol	ND	1700
2-Nitrophenol	ND	330
4-Nitrophenol	ND	1700
Pentachlorophenol	ND	1700
Phenol	ND	330
2,4,6-Trichlorophenol	ND	330

ug/Kg - Results are reported on a dry weight basis

LOD - Limit of Detection   ND - Not Detected at LOD

< - Compound was detected qualitatively below the LOD which makes quantification uncertain

Method - USEPA Contract Laboratory Program (CLP) Protocol, IFB WA 85-J178,1985

APPENDIX B
BORING LOGS

Log of test boring no. MW-3
Sheet 1 of 1
Project Cummins & Barnard

Location Selfridge ANGB

Drilling Contractor Keck

Crew Chief Dittmar

Sketch of Boring Location

Surface Elevation 575.02
Date Started 10/8/86
Date Completed 10/8/86
Boring Method Hollow Stem Auger

Monitor Well Yes
Elev. of top of well 576.63
Length of Screen 5'
Screen Mat'l PVC 2"
Depth to top of screen 24'
Seal from 9' to 12'

Hole plugged with Bentonite

Groundwater:
Encountered at ----- ft
After completion at ____ ft
After ____ hrs. ____ ft
Seepage at 13' ft
Boring caved at ____ ft

LEGEND:
SS - 2" split spoon sample
ST - Shelby tube sample
SNR - Sample not recovered
CS - core barrel sample

Signature

SAMPLE TYPE	DEPTH IN FEET	BLOW COUNT	SOIL DESCRIPTION
ST	2.0'		Brown clay with black and red/orange mottling, silty, < 1% pebbles CL
ST	4.5'		Brown clay, sandy with rusty nails and iron shards, cement pieces, < 1% pebbles CL
ST SNR	5		Black organic layer Pt
ST	10 10.5'		Brown/grey clay, silty low plasticity CL
	15		Grey clay with reddish/orange mottling, wet, high plasticity CH
	20		
	25		
	30		END OF BORING
	35		

Log of test boring no. MW-4
Sheet ___ of ___
Project Cummins & Barnard

Location Selfridge ANGB

Drilling Contractor Keck

Crew Chief Dittmar

Sketch of Boring Location

Surface Elevation 574.10
Date Started 10/7/86
Date Completed 10/7/86
Boring Method Hollow Stem Auger

Monitor Well Yes
Elev. of top of well 575.86
Length of Screen 5'
Screen Mat'l PVC - 2"
Depth to top of screen 24'
Seal from 9' to 12'

Hole plugged with ________

Groundwater:
Encountered at --- ft
After completion at ______ ft
After ______ hrs. ______ ft
Seepage at 13' ft
Boring caved at ______ ft

LEGEND:
SS - 2" split spoon sample
ST - Shelby tube sample
SNR - Sample not recovered
CS - core barrel sample

____
Signature

SAMPLE TYPE	DEPTH IN FEET	BLOW COUNT	SOIL DESCRIPTION
SS	2.0'		Black clay soil, fine grained sand, <1% pebbles, grading ~~grey/brown stiff mottled c~~ CL
SS	5		Grey clay, reddish/orange mottling, medium plasticit CL
SS	10		
SS	13.0'		Grey clay, moist, high plasticity CH
	15		
	20		
	25		
	29.0'		
	30		Grey clay - silty with reddish/orange specks CL
			END OF BORING
	35		

Log of test boring no. MW-5

Sheet ___ of ___

Project Cummins & Barnard

Location Selfridge ANGB

Drilling Contractor Keck

Crew Chief Dittmar

Sketch of Boring Location

Surface Elevation 573.97

Date Started 10/8/86

Date Completed 10/8/86

Boring Method Hollow Stem Auger

Monitor Well Yes

Elev. of top of well 575.84

Length of Screen 5'

Screen Mat'l PVC - 2"

Depth to top of screen 24'

Seal from 9' to 12'

Hole plugged with Bentonite

Groundwater:

Encountered at ---- ft

After completion at --- ft

After --- hrs. --- ft

Seepage at 6 ft

Boring caved at --- ft

LEGEND:

SS - 2" split spoon sample

ST - Shelby tube sample

SNR - Sample not recovered

CS - core barrel sample

Signature

SAMPLE TYPE	DEPTH IN FEET	BLOW COUNT	SOIL DESCRIPTION
ST	2.5'		Brown/black silty clay soil CL
ST	5		Brown/black sandy clay <50% sand with reddish/orange stains SC
	5.5'		Brown clay with black mottli[ng]
ST			Fine silt CL
			Blue-grey clay, medium plasticity CL
	10 / 10.5'		Blue/grey clay, stiff reddish
ST			orange mottling CL
	15		Grey clay, moist, high plasticity CH
	20		
	25		
	30		END OF BORING
	35		

Log of test boring no. MW-6
Sheet ___ of ___
Project Cummins & Barnard

Location Selfridge ANGB

Drilling Contractor Keck

Crew Chief Dittmar

Sketch of Boring Location

Surface Elevation 575.26
Date Started 10/8/86
Date Completed 10/9/86
Boring Method ___________

Monitor Well Yes
Elev. of top of well 577.66
Length of Screen 5'
Screen Mat'l PVC - 2"
Depth to top of screen 24'
Seal from 9' to 12'

Hole plugged with Bentonite

Groundwater:
Encountered at --- ft
After completion at ______ ft
After ______ hrs. ______ ft
Seepage at ______ ft
Boring caved at ______ ft

LEGEND:
SS - 2" split spoon sample
ST - Shelby tube sample
SNR - Sample not recovered
CS - core barrel sample

____
Signature

SAMPLE TYPE	DEPTH IN FEET	BLOW COUNT	SOIL DESCRIPTION
	2.5'		Brown clay soil, reddish/orange mottling, <1% pebble CL
	5		Black, decaying organic material, silty Pt
	6.0'		Black/brown clay with reddi[sh] ~~orange mottling, <1% pebble~~ CL
	10 10.5'		Grey/tan clay, reddish/oran[ge] mottling, fine silt, low plasticity, stiff CL
	15 20 25 30		Grey clay, moist, high plasticity CH
	35		END OF BORING

Log of test boring no. B-1

Sheet ___ of ___

Project Cummins & Barnard

Location Selfridge ANGB

Drilling Contractor Keck

Crew Chief Dittmar

Sketch of Boring Location

Surface Elevation 574.76

Date Started 10/9/86

Date Completed 10/9/86

Boring Method Hollow Stem Auger

Monitor Well NO

Elev. of top of well ______

Length of Screen ______

Screen Mat'l ______

Depth to top of screen ______

Seal from ____ to ______

Hole plugged with Bentonite

Groundwater:

Encountered at ______ ft

After completion at ______ ft

After ______ hrs. ______ ft

Seepage at ______ ft

Boring caved at ______ ft

LEGEND:

SS - 2" split spoon sample

ST - Shelby tube sample

SNR - Sample not recovered

CS - core barrel sample

______

Signature

SAMPLE TYPE	DEPTH IN FEET	BLOW COUNT	SOIL DESCRIPTION
ST	2.0'		Black/brown clay with red/ orange mottling, <1% pebbles, <50% sand
	2.5'		Brown sandy clay <1% pebbles
ST	3.5'		Black organic layer with reddish/orange stains
	5		Grey clay with reddish/orange mottling, stiff medium plasti
ST			Grey clay with green-reddish/ orange mottling, high plasticity
ST	10 11.0'		
	15		Grey, moist, high plasticity clay
	20 21.0'		
	25		Grey clay, stiff, medium plasticity
	30		END OF BORING
	35		

Log of test boring no B-2

Sheet ___ of ___

Project Cummins & Barnard

Location Selfridge ANGB

Drilling Contractor Keck

Crew Chief Dittmar

Sketch of Boring Location

Surface Elevation 574.74
Date Started 10/9/86
Date Completed 10/9/86
Boring Method Hollow Stem Auger

Monitor Well NO
Elev. of top of well ________
Length of Screen ________
Screen Mat'l ________
Depth to top of screen ________
Seal from ____ to ____

Hole plugged with Bentonite

Groundwater:
Encountered at ________ ft
After completion at ________ ft
After ________ hrs. ________ ft
Seepage at ________ ft
Boring caved at ________ ft

LEGEND:
SS - 2" split spoon sample
ST - Shelby tube sample
SNR - Sample not recovered
CS - core barrel sample

Signature

SAMPLE TYPE	DEPTH IN FEET	BLOW COUNT	SOIL DESCRIPTION
ST	2.0'		Brown clay soil with reddish orange staining, <1% pebble
ST	3.5'		Brown clay, crumbly, <1% pebbles CL
			Grey clay with brown/black mottling CL
	5		
ST			Brown clay, some grey mottling, stiff CL
	10		
ST			Grey, high plasticity clay, moist CH
	15		
	20		
			Grey, medium plasticity cla CL
	25		
	30		
			END OF BORING
	35		

Log of test boring no. B-3

Sheet ___ of ___

Project Cummins & Barnard

Location Selfridge ANGB

Drilling Contractor Keck

Crew Chief Dittmar

Sketch of Boring Location

Surface Elevation 573.79
Date Started 10/9/86
Date Completed 10/9/86
Boring Method Hollow Stem Auger

Monitor Well NO
Elev. of top of well ______
Length of Screen ______
Screen Mat'l ______
Depth to top of screen ______
Seal from ______ to ______

Hole plugged with Bentonite

Groundwater:
Encountered at ---- ft
After completion at ______ ft
After ______ hrs. ______ ft
Seepage at ______ ft
Boring caved at ______ ft

LEGEND:
SS - 2" split spoon sample
ST - Shelby tube sample
SNR - Sample not recovered
CS - core barrel sample

______
Signature

SAMPLE TYPE	DEPTH IN FEET	BLOW COUNT	SOIL DESCRIPTION
ST ST	3.5'		Brown clay with red/orange mottling <1% pebbles CL
	5		Black silty clay with brown stains CL
ST			Brown clay, some grey mottlin stiff CL
ST	10		Grey clay, moist, high plasticity CH
	15		
	20		Grey, medium plasticity clay CL
	25		
	30		END OF BORING
	35		

Log of test boring no. B-4
Sheet ___ of ___
Project Cummins & Barnard

Location Selfridge ANGB

Drilling Contractor Keck

Crew Chief Dittmar

Sketch of Boring Location

Surface Elevation 571.48
Date Started 10/10/86
Date Completed 10/10/86
Boring Method Hollow Stem Auger

Monitor Well NO
Elev. of top of well ______
Length of Screen ______
Screen Mat'l ______
Depth to top of screen ______
Seal from ____ to ______

Hole plugged with Bentonite

Groundwater:
Encountered at ---- ft
After completion at ______ ft
After ______ hrs. ______ ft
Seepage at ______ ft
Boring caved at ______ ft

LEGEND:
SS - 2" split spoon sample
ST - Shelby tube sample
SNR - Sample not recovered
CS - core barrel sample

____
Signature

SAMPLE TYPE	DEPTH IN FEET	BLOW COUNT	SOIL DESCRIPTION
	1.5'		Black clay CL
	5 6.5'		Grey clay, with reddish/ orange stains CL
	10 15 18.0'		Grey clay, moist, high plasticity CH
	20 25 30		Grey clay, stiff, low plasticity CL
	35		END OF BORING

APPENDIX C

METALS, THC, SULFIDE, AND CYANIDE RESULTS

TABLE 1
METALS AND TOTAL HYDROCARBONS FOR B1

Analyte*	B1 - Surface	B1 - 2 Ft.	B1 - 5 Ft.	B1 - 10 Ft.
Matrix	soil	soil	soil	soil
Arsenic	4.6	2.2	2.8	2.0
Barium	78.0	110.0	130.0	100.0
Cadmium	0.05	0.10	0.15	<0.05
Chromium	20.0	25.0	28.0	24.0
Copper	14.0	19.0	22.0	11.0
Lead	4.5	7.0	8.2	5.0
Mercury	<0.01	<0.01	<0.01	<0.01
Selenium	<0.1	0.4	0.2	<0.1
Silver	0.4	0.3	0.4	0.5
Zinc	45.0	55.0	52.0	35.0
THC**	<10.0	<20.0	<20.0	<20.0

* - Concentrations in mg/kg
** - Total Hydrocarbon as n-Hexane

TABLE 2
METALS AND TOTAL HYDROCARBONS FOR B2

Analyte*	B2 - Surface	B2 - 2 Ft.	B2 - 5 Ft.	B2 - 10 Ft.
Matrix	soil	soil	soil	soil
Arsenic	2.4	4.0	4.5	3.6
Barium	72.0	110.0	100.0	120.0
Cadmium	0.08	0.22	<0.05	<0.05
Chromium	19.0	22.0	22.0	28.0
Copper	14.0	19.0	11.0	16.0
Lead	5.5	11.0	5.2	5.0
Mercury	<0.01	<0.01	<0.01	<0.01
Selenium	<0.1	0.2	0.2	<0.1
Silver	0.6	0.4	0.4	0.4
Zinc	40.0	50.0	38.0	50.0
THC**	<10.0	<20.0	<20.0	<20.0

* - Concentrations in mg/kg
** - Total Hydrocarbon as n-Hexane

TABLE 3
METALS AND TOTAL HYDROCARBONS FOR B3

Analyte*	B3 - Surface	B3 - 2 Ft.	B3 - 5 Ft.	B3 - 10 Ft.
Matrix	soil	soil	soil	soil
Arsenic	4.2	3.9	4.0	2.0
Barium	85.0	90.0	110.0	130.0
Cadmium	0.08	0.08	0.08	<0.05
Chromium	14.0	22.0	25.0	28.0
Copper	10.0	16.0	20.0	19.0
Lead	9.0	8.0	8.0	6.2
Mercury	<0.01	<0.01	0.02	0.02
Selenium	<0.1	0.1	0.1	0.1
Silver	0.6	0.4	0.4	0.5
Zinc	40.0	50.0	55.0	52.0
THC**	<20.0	<20.0	<20.0	<20.0

* - Concentrations in mg/kg
** - Total Hydrocarbon as n-Hexane

TABLE 4
METALS AND TOTAL HYDROCARBONS FOR B4

Analyte*	B4 - Surface	B4 - 2 Ft.	B4 - 5 Ft.	B4 - 10 Ft.
Matrix	soil	soil	soil	soil
Arsenic	3.9	6.8	3.5	3.8
Barium	140.0	130.0	72.0	88.0
Cadmium	0.20	0.08	0.10	0.12
Chromium	39.0	30.0	24.0	24.0
Copper	23.0	20.0	16.0	12.0
Lead	9.2	7.2	6.0	5.2
Mercury	0.02	0.02	0.02	0.02
Selenium	<0.1	<0.1	0.3	0.3
Silver	0.4	0.4	0.4	0.3
Zinc	54.0	55.0	45.0	55.0
THC**	<20.0	<20.0	<20.0	<20.0

* - Concentrations in mg/kg
** - Total Hydrocarbon as n-Hexane

TABLE 5
METALS AND TOTAL HYDROCARBONS FOR MW-3

Analyte*	MW-3 - Surf.	MW-3 - 2 Ft.	MW-3 - 10 Ft.
Matrix	soil	soil	soil
Arsenic	6.5	3.9	4.3
Barium	90.0	90.0	140.0
Cadmium	0.20	0.15	0.10
Chromium	24.0	25.0	32.0
Copper	17.0	19.0	22.0
Lead	13.0	30.0	7.8
Mercury	<0.01	<0.01	<0.01
Selenium	0.1	<0.1	<0.1
Silver	0.3	0.4	0.4
Zinc	78.0	72.0	70.0
THC**	<20.0	<20.0	<20.0

* - Concentrations in mg/kg
** - Total Hydrocarbon as n-Hexane

TABLE 6
METALS AND TOTAL HYDROCARBONS FOR MW-4

Analyte*	MW-4 - Surf.	MW-4 - 2 Ft.	MW-4 - 5 Ft.	MW-4 - 10 Ft.
Matrix	soil	soil	soil	soil
Arsenic	3.7	4.6	3.4	3.7
Barium	42.0	100.0	140.0	100.0
Cadmium	0.42	0.20	0.06	0.08
Chromium	18.0	28.0	28.0	28.0
Copper	10.0	12.0	20.0	17.0
Lead	25.0	12.0	6.5	6.2
Mercury	<0.01	0.01	0.02	0.02
Selenium	<0.1	0.1	<0.1	<0.1
Silver	0.3	0.6	0.4	0.4
Zinc	40.0	50.0	62.0	62.0
THC**	<10.0	<20.0	<20.0	<20.0

* - Concentrations in mg/kg
** - Total Hydrocarbon as n-Hexane

TABLE 7
METALS AND TOTAL HYDROCARBONS FOR MW-5

Analyte*	MW-5 - Surf.	MW-5 - 2 Ft.	MW-5 - 5 Ft.	MW-5 - 10 Ft.
Matrix	soil	soil	soil	soil
Arsenic	3.4	3.3	3.8	2.5
Barium	62.0	110.0	100.0	92.0
Cadmium	0.12	0.12	0.08	<0.05
Chromium	20.0	25.0	28.0	24.0
Copper	9.5	18.0	17.0	12.0
Lead	12.0	9.0	7.8	5.5
Mercury	<0.01	<0.01	0.03	0.04
Selenium	<0.1	<0.1	<0.1	<0.1
Silver	0.3	0.4	0.4	0.4
Zinc	55.0	62.0	55.0	45.0
THC**	<10.0	<20.0	<20.0	<20.0

* - Concentrations in mg/kg
** - Total Hydrocarbon as n-Hexane

TABLE 8
METALS AND TOTAL HYDROCARBONS FOR MW-6

Analyte*	MW-6 - Surf.	MW-6 - 2 Ft.	MW-6 - 5 Ft.	MW-6 - 10 Ft.
Matrix	soil	soil	soil	soil
Arsenic	4.5	3.6	4.8	3.8
Barium	88.0	100.0	95.0	130.0
Cadmium	0.15	0.15	0.12	0.10
Chromium	19.0	24.0	22.0	30.0
Copper	14.0	22.0	18.0	20.0
Lead	10.0	32.0	20.0	9.5
Mercury	0.02	0.01	0.02	0.01
Selenium	<0.1	<0.1	<0.1	<0.1
Silver	0.5	0.2	0.4	0.4
Zinc	42.0	58.0	55.0	65.0
THC**	<20.0	<20.0	<20.0	<20.0

* - Concentrations in mg/kg
** - Total Hydrocarbon as n-Hexane

TABLE 9

METALS, THC, SULFIDES, CYANIDES FOR MW1, MW2, MW3, AND MW4

Analyte*	MW1	MW2	MW3	MW4
Matrix	water	water	water	water
Arsenic	<0.01	<0.01	<0.01	<0.01
Barium	0.25	0.42	0.54	0.43
Cadmium	<0.002	<0.002	<0.002	<0.002
Chromium	0.03	0.02	0.02	<0.02
Copper	0.03	0.02	0.02	<0.01
Lead	<0.02	<0.02	<0.02	<0.02
Mercury	0.0004	0.0004	0.0006	0.0003
Selenium	<0.01	<0.01	0.01	<0.01
Silver	<0.01	<0.01	<0.01	<0.01
Zinc	0.45	0.14	0.005	0.033
THC**	<4.0	<4.0	<4.0	<4.0
Sulfide	--.--	--.--	<1.0	<1.0
Cyanide	<0.01	<0.01	<0.01	<0.01

* - Concentrations in mg/L
** - Total Hydrocarbon as n-Hexane

TABLE 10

METALS, THC, SULFIDE, CYANIDE FOR MW6, BLANK I, BLANK II

Analyte*	MW6	BLANK I	BLANK II
Matrix	water	water	water
Arsenic	<0.01	<0.01	<0.01
Barium	0.65	<0.05	<0.05
Cadmium	<0.002	<0.002	<0.002
Chromium	0.02	<0.02	<0.02
Copper	0.03	<0.01	<0.01
Lead	<0.02	<0.02	<0.02
Mercury	0.0002	<0.0002	<0.002
Selenium	<0.01	<0.01	<0.01
Silver	<0.01	<0.01	<0.01
Zinc	0.058	<0.003	<0.003
THC**	<4.0	<4.0	<4.0
Sulfide	<1.0	<1.0	<1.0
Cyanide	<0.01	<0.01	<0.01

* - Concentrations in mg/L
** - Total Hydrocarbon as n-Hexane

APPENDIX D

RESULTS OF ANALYSES

FOR

BASE/NEUTRAL/ACID (BNA) COMPOUNDS

INDEX OF SAMPLE RESULTS IN APPENDIX D
BASE/NEUTRAL/ACID (BNA) COMPOUNDS

SAMPLE	SAMPLE MATRIX
MW-1	Water
MW-2	Water
MW-3	Water
MW-4	Water
MW-6	Water
Lab Blank L/W	Water
Lab Blank L/W	Water
Lab Blank II L/W	Water
MW-3 Matrix Spike	Water
MW-3 Matrix Spike Duplicate	Water

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503984
File No.: A6518
Sample Id.: MW-1

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	ND	10
Acenaphthylene	ND	10
Anthracene	ND	10
Benzo(a)anthracene	ND	10
Benzo(b)fluoranthene	ND	10
Benzo(k)fluoranthene	ND	10
Benzo(a)pyrene	ND	10
Benzo(ghi)perylene	ND	10
Benzyl alcohol	ND	10
Benzyl butyl phthalate	ND	10
Bis(2-chloroethyl)ether	ND	10
Bis(2-chloroethoxy)methane	ND	10
Bis(2-chloroisopropyl)ether	ND	10
Bis(2-ethylhexyl)phthalate	ND	20
4-Bromophenyl phenyl ether	ND	10
4-Chloroaniline	ND	10
2-Chloronaphthalene	ND	10
4-Chlorophenyl phenyl ether	ND	10
Chrysene	ND	10
Dibenzo(a,h)anthracene	ND	10
Dibenzofuran	ND	10
Di-n-butylphthalate	ND	10
1,2-Dichlorobenzene	ND	10
1,3-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
3,3'-Dichlorobenzidine	ND	20
Diethyl phthalate	ND	10
Dimethyl phthalate	ND	10
2,4-Dinitrotoluene	ND	10
2,6-Dinitrotoluene	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No: 36041-19
Lab No: 503984
File No: A6518
Sample Id.: MW-1

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	10
Fluoranthene	ND	10
Fluorene	ND	10
Hexachlorobenzene	ND	10
Hexachlorobutadiene	ND	10
Hexachlorocyclopentadiene	ND	10
Hexachloroethane	ND	10
Indeno(1,2,3-cd)pyrene	ND	10
Isophorone	ND	10
2-Methylnaphthalene	ND	10
Naphthalene	ND	10
2-Nitroaniline	ND	50
3-Nitroaniline	ND	50
4-Nitroaniline	ND	50
Nitrobenzene	ND	10
N-Nitrosodi-n-propylamine	ND	10
N-Nitrosodiphenylamine	ND	10
Phenanthrene	ND	10
Pyrene	ND	10
1,2,4-Trichlorobenzene	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503984
File No.: A6518
Sample Id.: MW-1

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	50
4-Chloro-3-methylphenol	ND	10
2-Chlorophenol	ND	10
2,4-Dichlorophenol	ND	10
2,4-Dimethylphenol	ND	10
2,4-Dinitrophenol	ND	50
2-Methyl-4,6-dinitrophenol	ND	50
2-Methylphenol	ND	10
4-Methylphenol	ND	10
2-Nitrophenol	ND	10
4-Nitrophenol	ND	50
Pentachlorophenol	ND	50
Phenol	ND	10
2,4,5-Trichlorophenol	ND	50
2,4,6-Trichlorophenol	ND	10

LOD - Limit of Detection   ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503984
File No.: A6518
Sample Id.: MW-1

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Semi-volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503985
File No.: A6519
Sample Id.: MW-2

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	ND	10
Acenaphthylene	ND	10
Anthracene	ND	10
Benzo(a)anthracene	ND	10
Benzo(b)fluoranthene	ND	10
Benzo(k)fluoranthene	ND	10
Benzo(a)pyrene	ND	10
Benzo(ghi)perylene	ND	10
Benzyl alcohol	ND	10
Benzyl butyl phthalate	ND	10
Bis(2-chloroethyl)ether	ND	10
Bis(2-chloroethoxy)methane	ND	10
Bis(2-chloroisopropyl)ether	ND	10
Bis(2-ethylhexyl)phthalate	ND	20
4-Bromophenyl phenyl ether	ND	10
4-Chloroaniline	ND	10
2-Chloronaphthalene	ND	10
4-Chlorophenyl phenyl ether	ND	10
Chrysene	ND	10
Dibenzo(a,h)anthracene	ND	10
Dibenzofuran	ND	10
Di-n-butylphthalate	ND	10
1,2-Dichlorobenzene	ND	10
1,3-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
3,3'-Dichlorobenzidine	ND	20
Diethyl phthalate	ND	10
Dimethyl phthalate	ND	10
2,4-Dinitrotoluene	ND	10
2,6-Dinitrotoluene	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No: 36041-19
Lab No: 503985
File No: A6519
Sample Id.: MW-2

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	10
Fluoranthene	ND	10
Fluorene	ND	10
Hexachlorobenzene	ND	10
Hexachlorobutadiene	ND	10
Hexachlorocyclopentadiene	ND	10
Hexachloroethane	ND	10
Indeno(1,2,3-cd)pyrene	ND	10
Isophorone	ND	10
2-Methylnaphthalene	ND	10
Naphthalene	ND	10
2-Nitroaniline	ND	50
3-Nitroaniline	ND	50
4-Nitroaniline	ND	50
Nitrobenzene	ND	10
N-Nitrosodi-n-propylamine	ND	10
N-Nitrosodiphenylamine	ND	10
Phenanthrene	ND	10
Pyrene	ND	10
1,2,4-Trichlorobenzene	ND	10

LOD - Limit of Detection　　ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503985
File No.: A6519
Sample Id.: MW-2

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	50
4-Chloro-3-methylphenol	ND	10
2-Chlorophenol	ND	10
2,4-Dichlorophenol	ND	10
2,4-Dimethylphenol	ND	10
2,4-Dinitrophenol	ND	50
2-Methyl-4,6-dinitrophenol	ND	50
2-Methylphenol	ND	10
4-Methylphenol	ND	10
2-Nitrophenol	ND	10
4-Nitrophenol	ND	50
Pentachlorophenol	ND	50
Phenol	ND	10
2,4,5-Trichlorophenol	ND	50
2,4,6-Trichlorophenol	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503985
File No.: A6519
Sample Id.: MW-2

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Semi-volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503986
File No.: A6520
Sample Id.: MW-3

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	ND	10
Acenaphthylene	ND	10
Anthracene	ND	10
Benzo(a)anthracene	ND	10
Benzo(b)fluoranthene	ND	10
Benzo(k)fluoranthene	ND	10
Benzo(a)pyrene	ND	10
Benzo(ghi)perylene	ND	10
Benzyl alcohol	ND	10
Benzyl butyl phthalate	ND	10
Bis(2-chloroethyl)ether	ND	10
Bis(2-chloroethoxy)methane	ND	10
Bis(2-chloroisopropyl)ether	ND	10
Bis(2-ethylhexyl)phthalate	ND	20
4-Bromophenyl phenyl ether	ND	10
4-Chloroaniline	ND	10
2-Chloronaphthalene	ND	10
4-Chlorophenyl phenyl ether	ND	10
Chrysene	ND	10
Dibenzo(a,h)anthracene	ND	10
Dibenzofuran	ND	10
Di-n-butylphthalate	ND	10
1,2-Dichlorobenzene	ND	10
1,3-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
3,3'-Dichlorobenzidine	ND	20
Diethyl phthalate	ND	10
Dimethyl phthalate	ND	10
2,4-Dinitrotoluene	ND	10
2,6-Dinitrotoluene	ND	10

LOD - Limit of Detection   ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No: 36041-19
Lab No: 503986
File No: A6520
Sample Id.: MW-3

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	10
Fluoranthene	ND	10
Fluorene	ND	10
Hexachlorobenzene	ND	10
Hexachlorobutadiene	ND	10
Hexachlorocyclopentadiene	ND	10
Hexachloroethane	ND	10
Indeno(1,2,3-cd)pyrene	ND	10
Isophorone	ND	10
2-Methylnaphthalene	ND	10
Naphthalene	ND	10
2-Nitroaniline	ND	50
3-Nitroaniline	ND	50
4-Nitroaniline	ND	50
Nitrobenzene	ND	10
N-Nitrosodi-n-propylamine	ND	10
N-Nitrosodiphenylamine	ND	10
Phenanthrene	ND	10
Pyrene	ND	10
1,2,4-Trichlorobenzene	ND	10

LOD - Limit of Detection   ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503986
File No.: A6520
Sample Id.: MW-3

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	50
4-Chloro-3-methylphenol	ND	10
2-Chlorophenol	ND	10
2,4-Dichlorophenol	ND	10
2,4-Dimethylphenol	ND	10
2,4-Dinitrophenol	ND	50
2-Methyl-4,6-dinitrophenol	ND	50
2-Methylphenol	ND	10
4-Methylphenol	ND	10
2-Nitrophenol	ND	10
4-Nitrophenol	ND	50
Pentachlorophenol	ND	50
Phenol	ND	10
2,4,5-Trichlorophenol	ND	50
2,4,6-Trichlorophenol	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503986
File No.: A6520
Sample Id.: MW-3

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Semi-volatile fraction		
4-hydroxy-4-methyl-2-pentanone	5.78	100

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503987
File No.: A6521
Sample Id.: MW-4

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	ND	10
Acenaphthylene	ND	10
Anthracene	ND	10
Benzo(a)anthracene	ND	10
Benzo(b)fluoranthene	ND	10
Benzo(k)fluoranthene	ND	10
Benzo(a)pyrene	ND	10
Benzo(ghi)perylene	ND	10
Benzyl alcohol	ND	10
Benzyl butyl phthalate	ND	10
Bis(2-chloroethyl)ether	ND	10
Bis(2-chloroethoxy)methane	ND	10
Bis(2-chloroisopropyl)ether	ND	10
Bis(2-ethylhexyl)phthalate	ND	20
4-Bromophenyl phenyl ether	ND	10
4-Chloroaniline	ND	10
2-Chloronaphthalene	ND	10
4-Chlorophenyl phenyl ether	ND	10
Chrysene	ND	10
Dibenzo(a,h)anthracene	ND	10
Dibenzofuran	ND	10
Di-n-butylphthalate	ND	10
1,2-Dichlorobenzene	ND	10
1,3-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
3,3'-Dichlorobenzidine	ND	20
Diethyl phthalate	ND	10
Dimethyl phthalate	ND	10
2,4-Dinitrotoluene	ND	10
2,6-Dinitrotoluene	ND	10

LOD - Limit of Detection　　ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No: 36041-19
Lab No: 503987
File No: A6521
Sample Id.: MW-4

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	10
Fluoranthene	ND	10
Fluorene	ND	10
Hexachlorobenzene	ND	10
Hexachlorobutadiene	ND	10
Hexachlorocyclopentadiene	ND	10
Hexachloroethane	ND	10
Indeno(1,2,3-cd)pyrene	ND	10
Isophorone	ND	10
2-Methylnaphthalene	ND	10
Naphthalene	ND	10
2-Nitroaniline	ND	50
3-Nitroaniline	ND	50
4-Nitroaniline	ND	50
Nitrobenzene	ND	10
N-Nitrosodi-n-propylamine	ND	10
N-Nitrosodiphenylamine	ND	10
Phenanthrene	ND	10
Pyrene	ND	10
1,2,4-Trichlorobenzene	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503987
File No.: A6521
Sample Id.: MW-4

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	50
4-Chloro-3-methylphenol	ND	10
2-Chlorophenol	ND	10
2,4-Dichlorophenol	ND	10
2,4-Dimethylphenol	ND	10
2,4-Dinitrophenol	ND	50
2-Methyl-4,6-dinitrophenol	ND	50
2-Methylphenol	ND	10
4-Methylphenol	ND	10
2-Nitrophenol	ND	10
4-Nitrophenol	ND	50
Pentachlorophenol	ND	50
Phenol	ND	10
2,4,5-Trichlorophenol	ND	50
2,4,6-Trichlorophenol	ND	10

LOD - Limit of Detection ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503987
File No.: A6521
Sample Id.: MW-4

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Semi-volatile fraction		
4-hydroxy-4-methyl-2-pentanone	5.78	100

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 502425
File No.: A6425
Sample Id.: MW-6

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	ND	10
Acenaphthylene	ND	10
Anthracene	ND	10
Benzo(a)anthracene	ND	10
Benzo(b)fluoranthene	ND	10
Benzo(k)fluoranthene	ND	10
Benzo(a)pyrene	ND	10
Benzo(ghi)perylene	ND	10
Benzyl alcohol	ND	10
Benzyl butyl phthalate	ND	10
Bis(2-chloroethyl)ether	ND	10
Bis(2-chloroethoxy)methane	ND	10
Bis(2-chloroisopropyl)ether	ND	10
Bis(2-ethylhexyl)phthalate	ND	10
4-Bromophenyl phenyl ether	ND	10
4-Chloroaniline	ND	10
2-Chloronaphthalene	ND	10
4-Chlorophenyl phenyl ether	ND	10
Chrysene	ND	10
Dibenzo(a,h)anthracene	ND	10
Dibenzofuran	ND	10
Di-n-butylphthalate	ND	10
1,2-Dichlorobenzene	ND	10
1,3-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
3,3'-Dichlorobenzidine	ND	20
Diethyl phthalate	ND	10
Dimethyl phthalate	ND	10
2,4-Dinitrotoluene	ND	10
2,6-Dinitrotoluene	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD, INC.

Project No: 36041-19
Lab No: 502425
File No: A6425
Sample Id.: MW-6

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	10
Fluoranthene	ND	10
Fluorene	ND	10
Hexachlorobenzene	ND	10
Hexachlorobutadiene	ND	10
Hexachlorocyclopentadiene	ND	10
Hexachloroethane	ND	10
Indeno(1,2,3-cd)pyrene	ND	10
Isophorone	ND	10
2-Methylnaphthalene	ND	10
Naphthalene	ND	10
2-Nitroaniline	ND	50
3-Nitroaniline	ND	50
4-Nitroaniline	ND	50
Nitrobenzene	ND	10
N-Nitrosodi-n-propylamine	ND	10
N-Nitrosodiphenylamine	ND	10
Phenanthrene	ND	10
Pyrene	ND	10
1,2,4-Trichlorobenzene	ND	10

LOD - Limit of Detection   ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 502425
File No.: A6425
Sample Id.: MW-6

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	50
4-Chloro-3-methylphenol	ND	10
2-Chlorophenol	ND	10
2,4-Dichlorophenol	ND	10
2,4-Dimethylphenol	ND	10
2,4-Dinitrophenol	ND	50
2-Methyl-4,6-dinitrophenol	ND	50
2-Methylphenol	ND	10
4-Methylphenol	ND	10
2-Nitrophenol	ND	10
4-Nitrophenol	ND	50
Pentachlorophenol	ND	50
Phenol	ND	10
2,4,5-Trichlorophenol	ND	50
2,4,6-Trichlorophenol	ND	10

Results have been blank corrected.

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD,INC.

Project No.: 36041-19
Lab No.: 502425
File No.: A6425
Sample Id.: MW-6

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Semi-volatile fraction		
no compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: A6424
Sample Id.: LAB BLANK L/W

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	ND	10
Acenaphthylene	ND	10
Anthracene	ND	10
Benzo(a)anthracene	ND	10
Benzo(b)fluoranthene	ND	10
Benzo(k)fluoranthene	ND	10
Benzo(a)pyrene	ND	10
Benzo(ghi)perylene	ND	10
Benzyl alcohol	ND	10
Benzyl butyl phthalate	ND	10
Bis(2-chloroethyl)ether	ND	10
Bis(2-chloroethoxy)methane	ND	10
Bis(2-chloroisopropyl)ether	ND	10
Bis(2-ethylhexyl)phthalate	ND	10
4-Bromophenyl phenyl ether	ND	10
4-Chloroaniline	ND	10
2-Chloronaphthalene	ND	10
4-Chlorophenyl phenyl ether	ND	10
Chrysene	ND	10
Dibenzo(a,h)anthracene	ND	10
Dibenzofuran	ND	10
Di-n-butylphthalate	ND	10
1,2-Dichlorobenzene	ND	10
1,3-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
3,3'-Dichlorobenzidine	ND	20
Diethyl phthalate	ND	10
Dimethyl phthalate	ND	10
2,4-Dinitrotoluene	ND	10
2,6-Dinitrotoluene	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD, INC.

Project No: 36041-19
Lab No: ------
File No: A6424
Sample Id.: LAB BLANK L/W

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	10
Fluoranthene	ND	10
Fluorene	ND	10
Hexachlorobenzene	ND	10
Hexachlorobutadiene	ND	10
Hexachlorocyclopentadiene	ND	10
Hexachloroethane	ND	10
Indeno(1,2,3-cd)pyrene	ND	10
Isophorone	ND	10
2-Methylnaphthalene	ND	10
Naphthalene	ND	10
2-Nitroaniline	ND	50
3-Nitroaniline	ND	50
4-Nitroaniline	ND	50
Nitrobenzene	ND	10
N-Nitrosodi-n-propylamine	ND	10
N-Nitrosodiphenylamine	ND	10
Phenanthrene	ND	10
Pyrene	ND	10
1,2,4-Trichlorobenzene	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD,INC.

Project No.: 36041-19
Lab No.: ------
File No.: A6424
Sample Id.: LAB BLANK L/W

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	50
4-Chloro-3-methylphenol	ND	10
2-Chlorophenol	ND	10
2,4-Dichlorophenol	ND	10
2,4-Dimethylphenol	ND	10
2,4-Dinitrophenol	ND	50
2-Methyl-4,6-dinitrophenol	ND	50
2-Methylphenol	ND	10
4-Methylphenol	ND	10
2-Nitrophenol	ND	10
4-Nitrophenol	ND	50
Pentachlorophenol	ND	50
Phenol	ND	10
2,4,5-Trichlorophenol	ND	50
2,4,6-Trichlorophenol	ND	10

Results have been blank corrected.

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD,INC.

Project No.: 36041-19
Lab No.: ------
File No.: A6424
Sample Id.: LAB BLANK L/W

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Semi-volatile fraction		
Ethanol, 2-butoxy-	7.47	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: ------
File No.: A6517
Sample Id.: LAB BLANK L/W

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	ND	10
Acenaphthylene	ND	10
Anthracene	ND	10
Benzo(a)anthracene	ND	10
Benzo(b)fluoranthene	ND	10
Benzo(k)fluoranthene	ND	10
Benzo(a)pyrene	ND	10
Benzo(ghi)perylene	ND	10
Benzyl alcohol	ND	10
Benzyl butyl phthalate	ND	10
Bis(2-chloroethyl)ether	ND	10
Bis(2-chloroethoxy)methane	ND	10
Bis(2-chloroisopropyl)ether	ND	10
Bis(2-ethylhexyl)phthalate	ND	20
4-Bromophenyl phenyl ether	ND	10
4-Chloroaniline	ND	10
2-Chloronaphthalene	ND	10
4-Chlorophenyl phenyl ether	ND	10
Chrysene	ND	10
Dibenzo(a,h)anthracene	ND	10
Dibenzofuran	ND	10
Di-n-butylphthalate	ND	10
1,2-Dichlorobenzene	ND	10
1,3-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
3,3'-Dichlorobenzidine	ND	20
Diethyl phthalate	ND	10
Dimethyl phthalate	ND	10
2,4-Dinitrotoluene	ND	10
2,6-Dinitrotoluene	ND	10

LOD - Limit of Detection   ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No: 36041-19
Lab No: ------
File No: A6517
Sample Id.: LAB BLANK L/W

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	10
Fluoranthene	ND	10
Fluorene	ND	10
Hexachlorobenzene	ND	10
Hexachlorobutadiene	ND	10
Hexachlorocyclopentadiene	ND	10
Hexachloroethane	ND	10
Indeno(1,2,3-cd)pyrene	ND	10
Isophorone	ND	10
2-Methylnaphthalene	ND	10
Naphthalene	ND	10
2-Nitroaniline	ND	50
3-Nitroaniline	ND	50
4-Nitroaniline	ND	50
Nitrobenzene	ND	10
N-Nitrosodi-n-propylamine	ND	10
N-Nitrosodiphenylamine	ND	10
Phenanthrene	ND	10
Pyrene	ND	10
1,2,4-Trichlorobenzene	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: ------
File No.: A6517
Sample Id.: LAB BLANK L/W

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	50
4-Chloro-3-methylphenol	ND	10
2-Chlorophenol	ND	10
2,4-Dichlorophenol	ND	10
2,4-Dimethylphenol	ND	10
2,4-Dinitrophenol	ND	50
2-Methyl-4,6-dinitrophenol	ND	50
2-Methylphenol	ND	10
4-Methylphenol	ND	10
2-Nitrophenol	ND	10
4-Nitrophenol	ND	50
Pentachlorophenol	ND	50
Phenol	ND	10
2,4,5-Trichlorophenol	ND	50
2,4,6-Trichlorophenol	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 38041-19
Lab No.: ------
File No.: A6517
Sample Id.: LAB BLANK L/W

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Semi-volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: ------
File No.: A6522
Sample Id.: LAB BLANK II L/W

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	ND	20
Acenaphthylene	ND	20
Anthracene	ND	20
Benzo(a)anthracene	ND	20
Benzo(b)fluoranthene	ND	20
Benzo(k)fluoranthene	ND	20
Benzo(a)pyrene	ND	20
Benzo(ghi)perylene	ND	20
Benzyl alcohol	ND	20
Benzyl butyl phthalate	ND	20
Bis(2-chloroethyl)ether	ND	20
Bis(2-chloroethoxy)methane	ND	20
Bis(2-chloroisopropyl)ether	ND	20
Bis(2-ethylhexyl)phthalate	ND	40
4-Bromophenyl phenyl ether	ND	20
4-Chloroaniline	ND	20
2-Chloronaphthalene	ND	20
4-Chlorophenyl phenyl ether	ND	20
Chrysene	ND	20
Dibenzo(a,h)anthracene	ND	20
Dibenzofuran	ND	20
Di-n-butylphthalate	ND	20
1,2-Dichlorobenzene	ND	20
1,3-Dichlorobenzene	ND	20
1,4-Dichlorobenzene	ND	20
3,3'-Dichlorobenzidine	ND	40
Diethyl phthalate	ND	20
Dimethyl phthalate	ND	20
2,4-Dinitrotoluene	ND	20
2,6-Dinitrotoluene	ND	20

LOD - Limit of Detection   ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No: 36041-19
Lab No: ------
File No: A6522
Sample Id.: LAB BLANK II L/W

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	20
Fluoranthene	ND	20
Fluorene	ND	20
Hexachlorobenzene	ND	20
Hexachlorobutadiene	ND	20
Hexachlorocyclopentadiene	ND	20
Hexachloroethane	ND	20
Indeno(1,2,3-cd)pyrene	ND	20
Isophorone	ND	20
2-Methylnaphthalene	ND	20
Naphthalene	ND	20
2-Nitroaniline	ND	100
3-Nitroaniline	ND	100
4-Nitroaniline	ND	100
Nitrobenzene	ND	20
N-Nitrosodi-n-propylamine	ND	20
N-Nitrosodiphenylamine	ND	20
Phenanthrene	ND	20
Pyrene	ND	20
1,2,4-Trichlorobenzene	ND	20

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: ------
File No.: A6522
Sample Id.: LAB BLANK II L/W

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	100
4-Chloro-3-methylphenol	ND	20
2-Chlorophenol	ND	20
2,4-Dichlorophenol	ND	20
2,4-Dimethylphenol	ND	20
2,4-Dinitrophenol	ND	100
2-Methyl-4,6-dinitrophenol	ND	100
2-Methylphenol	ND	20
4-Methylphenol	ND	20
2-Nitrophenol	ND	20
4-Nitrophenol	ND	100
Pentachlorophenol	ND	100
Phenol	ND	20
2,4,5-Trichlorophenol	ND	100
2,4,6-Trichlorophenol	ND	20

LOD - Limit of Detection   ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: A6522
Sample Id.: LAB BLANK II L/W

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Semi-volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503986 matrix spike
File No.: A6523
Sample Id.: MW-3

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	130 ms	20
Acenaphthylene	ND	20
Anthracene	ND	20
Benzo(a)anthracene	ND	20
Benzo(b)fluoranthene	ND	20
Benzo(k)fluoranthene	ND	20
Benzo(a)pyrene	ND	20
Benzo(ghi)perylene	ND	20
Benzyl alcohol	ND	20
Benzyl butyl phthalate	ND	20
Bis(2-chloroethyl)ether	ND	20
Bis(2-chloroethoxy)methane	ND	20
Bis(2-chloroisopropyl)ether	ND	20
Bis(2-ethylhexyl)phthalate	ND	40
4-Bromophenyl phenyl ether	ND	20
4-Chloroaniline	ND	20
2-Chloronaphthalene	ND	20
4-Chlorophenyl phenyl ether	ND	20
Chrysene	ND	20
Dibenzo(a,h)anthracene	ND	20
Dibenzofuran	ND	20
Di-n-butylphthalate	ND	20
1,2-Dichlorobenzene	ND	20
1,3-Dichlorobenzene	ND	20
1,4-Dichlorobenzene	110 ms	20
3,3'-Dichlorobenzidine	ND	40
Diethyl phthalate	ND	20
Dimethyl phthalate	ND	20
2,4-Dinitrotoluene	180 ms	20
2,6-Dinitrotoluene	ND	20

ms - matrix spike compound. 200 ug/L added.

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No: 36041-19
Lab No: 503986 matrix spike
File No: A6523
Sample Id.: MW-3

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	20
Fluoranthene	ND	20
Fluorene	ND	20
Hexachlorobenzene	ND	20
Hexachlorobutadiene	ND	20
Hexachlorocyclopentadiene	ND	20
Hexachloroethane	ND	20
Indeno(1,2,3-cd)pyrene	ND	20
Isophorone	ND	20
2-Methylnaphthalene	ND	20
Naphthalene	ND	20
2-Nitroaniline	ND	20
3-Nitroaniline	ND	100
4-Nitroaniline	ND	100
Nitrobenzene	ND	100
N-Nitrosodi-n-propylamine	ND	20
N-Nitrosodiphenylamine	120 ms	20
Phenanthrene	ND	20
Pyrene	ND	20
1,2,4-Trichlorobenzene	180 ms	20
	120 ms	20

ms - matrix spike compound. 200 ug/L added.

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503986 matrix spike
File No.: A6523
Sample Id.: MW-3

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	100
4-Chloro-3-methylphenol	280 ms	20
2-Chlorophenol	150 ms	20
2,4-Dichlorophenol	ND	20
2,4-Dimethylphenol	ND	20
2,4-Dinitrophenol	ND	100
2-Methyl-4,6-dinitrophenol	ND	100
2-Methylphenol	ND	20
4-Methylphenol	ND	20
2-Nitrophenol	ND	20
4-Nitrophenol	9 ms	100
Pentachlorophenol	44 ms	100
Phenol	120 ms	20
2,4,5-Trichlorophenol	ND	100
2,4,6-Trichlorophenol	ND	20

ms - matrix spike compound. 400 ug/L added.

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503986 matrix spike duplicate
File No.: A6524
Sample Id.: MW-3

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	130 ms	20
Acenaphthylene	ND	20
Anthracene	ND	20
Benzo(a)anthracene	ND	20
Benzo(b)fluoranthene	ND	20
Benzo(k)fluoranthene	ND	20
Benzo(a)pyrene	ND	20
Benzo(ghi)perylene	ND	20
Benzyl alcohol	ND	20
Benzyl butyl phthalate	ND	20
Bis(2-chloroethyl)ether	ND	20
Bis(2-chloroethoxy)methane	ND	20
Bis(2-chloroisopropyl)ether	ND	20
Bis(2-ethylhexyl)phthalate	ND	40
4-Bromophenyl phenyl ether	ND	20
4-Chloroaniline	ND	20
2-Chloronaphthalene	ND	20
4-Chlorophenyl phenyl ether	ND	20
Chrysene	ND	20
Dibenzo(a,h)anthracene	ND	20
Dibenzofuran	ND	20
Di-n-butylphthalate	ND	20
1,2-Dichlorobenzene	ND	20
1,3-Dichlorobenzene	ND	20
1,4-Dichlorobenzene	120 ms	20
3,3'-Dichlorobenzidine	ND	40
Diethyl phthalate	ND	20
Dimethyl phthalate	ND	20
2,4-Dinitrotoluene	190 ms	20
2,6-Dinitrotoluene	ND	20

ms - matrix spike compound. 200 ug/L added.

LOD - Limit of Detection ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No: 36041-19
Lab No: 503986 matrix spike duplicate
File No: A6524
Sample Id.: MW-3

Base Neutral Compounds - Hazardous Substance list

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Di-n-octylphthalate	ND	20
Fluoranthene	ND	20
Fluorene	ND	20
Hexachlorobenzene	ND	20
Hexachlorobutadiene	ND	20
Hexachlorocyclopentadiene	ND	20
Hexachloroethane	ND	20
Indeno(1,2,3-cd)pyrene	ND	20
Isophorone	ND	20
2-Methylnaphthalene	ND	20
Naphthalene	ND	20
2-Nitroaniline	ND	100
3-Nitroaniline	ND	100
4-Nitroaniline	ND	100
Nitrobenzene	ND	20
N-Nitrosodi-n-propylamine	130 ms	20
N-Nitrosodiphenylamine	ND	20
Phenanthrene	ND	20
Pyrene	150 ms	20
1,2,4-Trichlorobenzene	120 ms	20

ms - matrix spike compound. 200 ug/L added.

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for: CUMMINS AND BARNARD INC.

Project No.: 36041-19
Lab No.: 503986 matrix spike duplicate
File No.: A6524
Sample Id.: MW-3

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	100
4-Chloro-3-methylphenol	28 ms	20
2-Chlorophenol	28 ms	20
2,4-Dichlorophenol	ND	20
2,4-Dimethylphenol	ND	20
2,4-Dinitrophenol	ND	100
2-Methyl-4,6-dinitrophenol	ND	100
2-Methylphenol	ND	20
4-Methylphenol	ND	20
2-Nitrophenol	ND	20
4-Nitrophenol	15 ms	100
Pentachlorophenol	20 ms	100
Phenol	18 ms	20
2,4,5-Trichlorophenol	ND	100
2,4,6-Trichlorophenol	ND	20

ms - matrix spike compound. 400 ug/L added.

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

APPENDIX E

PESTICIDE AND PCB RESULTS

INDEX OF SAMPLE RESULTS IN APPENDIX E
PESTICIDE AND PCB RESULTS

SAMPLE	SAMPLE MATRIX
MW-3 Surface	Soil
MW-3 2 Ft.	Soil
MW-3 10 Ft.	Soil
MW-4 Surface	Soil
MW-4 2 Ft.	Soil
MW-4 5 Ft.	Soil
MW-4 10 Ft.	Soil
MW-5 Surface	Soil
MW-5 2 Ft.	Soil
MW-5 5 Ft.	Soil
MW-5 10 Ft.	Soil
MW-6 Surface	Soil
MW-6 2 Ft.	Soil
MW-6 5 Ft.	Soil
MW-6 10 Ft.	Soil
B1 Surface	Soil
B1 2 Ft.	Soil
B1 5 Ft.	Soil
B1 10 Ft.	Soil
B2 Surface	Soil
B2 2 Ft.	Soil
B2 5 Ft.	Soil
B2 10 Ft.	Soil
B3 Surface	Soil
B3 2 Ft.	Soil
B3 5 Ft.	Soil
B3 10 Ft.	Soil
B4 Surface	Soil
B4 2 Ft.	Soil
B4 5 Ft.	Soil
B4 10 Ft.	Soil
MW-1	Water
MW-2	Water
MW-3	Water
MW-4	Water
MW-6	Water
Lab Soil Blank I	Soil
Lab Soil Blank II	Soil
Water Blank I	Water
Water Blank II	Water
Lab Water Blank I	Water
MW-2 Matrix Spike	Water
MW-2 Matrix Spike Duplicate	Water

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498816
Sample Description: MW-3 Surface

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	9.
beta-BHC	N.D.	9.
delta-BHC	N.D.	9.
gamma-BHC (Lindane)	N.D.	9.
Heptachlor	N.D.	9.
Aldrin	N.D.	9.
Heptachlor Epoxide	N.D.	9.
Endosulfan I	N.D.	9.
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	90
Technical Chlordane	N.D.	90
Toxaphene	N.D.	200
A-1016	N.D.	90
A-1221	N.D.	90
A-1232	N.D.	90
A-1242	N.D.	90
A-1248	N.D.	90
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498817
Sample Description: MW-3 2 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	9.
beta-BHC	N.D.	9.
delta-BHC	N.D.	9.
gamma-BHC (Lindane)	N.D.	9.
Heptachlor	N.D.	9.
Aldrin	N.D.	9.
Heptachlor Epoxide	N.D.	9.
Endosulfan I	N.D.	9.
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	90
Technical Chlordane	N.D.	90
Toxaphene	N.D.	200
A-1016	N.D.	90
A-1221	N.D.	90
A-1232	N.D.	90
A-1242	N.D.	90
A-1248	N.D.	90
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498818
Sample Description: MW-3 10 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498808
Sample Description: MW-4 Surface

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	9.
beta-BHC	N.D.	9.
delta-BHC	N.D.	9.
gamma-BHC (Lindane)	N.D.	9.
Heptachlor	N.D.	9.
Aldrin	N.D.	9.
Heptachlor Epoxide	N.D.	9.
Endosulfan I	N.D.	9.
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	90
Technical Chlordane	N.D.	90
Toxaphene	N.D.	200
A-1016	N.D.	90
A-1221	N.D.	90
A-1232	N.D.	90
A-1242	N.D.	90
A-1248	N.D.	90
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498809
Sample Description: MW-4 2 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498810
Sample Description: MW-4 5 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498811
Sample Description: MW-4 10 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498812
Sample Description: MW-5 Surface

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	9.
beta-BHC	N.D.	9.
delta-BHC	N.D.	9.
gamma-BHC (Lindane)	N.D.	9.
Heptachlor	N.D.	9.
Aldrin	N.D.	9.
Heptachlor Epoxide	N.D.	9.
Endosulfan I	N.D.	9.
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	90
Technical Chlordane	N.D.	90
Toxaphene	N.D.	200
A-1016	N.D.	90
A-1221	N.D.	90
A-1232	N.D.	90
A-1242	N.D.	90
A-1248	N.D.	90
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498813
Sample Description: MW-5 2 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498814
Sample Description: MW-5 5 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	20
beta-BHC	N.D.	20
delta-BHC	N.D.	20
gamma-BHC (Lindane)	N.D.	20
Heptachlor	N.D.	20
Aldrin	N.D.	20
Heptachlor Epoxide	N.D.	20
Endosulfan I	N.D.	20
Dieldrin	N.D.	40
4,4'-DDE	N.D.	40
Endrin	N.D.	40
Endosulfan II	N.D.	40
4,4'-DDD	N.D.	40
Endosulfan Sulfate	N.D.	40
4,4'-DDT	N.D.	40
Endrin Ketone	N.D.	40
Methoxychlor	N.D.	200
Technical Chlordane	N.D.	200
Toxaphene	N.D.	400
A-1016	N.D.	200
A-1221	N.D.	200
A-1232	N.D.	200
A-1242	N.D.	200
A-1248	N.D.	200
A-1254	N.D.	400
A-1260	N.D.	400

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498815
Sample Description: MW-5 10 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 438819
Sample Description: MW-6 Surface

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498820
Sample Description: MW-6 2 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	600
beta-BHC	N.D.	600
delta-BHC	N.D.	600
gamma-BHC (Lindane)	N.D.	600
Heptachlor	N.D.	600
Aldrin	N.D.	600
Heptachlor Epoxide	N.D.	600
Endosulfan I	N.D.	600
Dieldrin	N.D.	1000
4,4'-DDE	N.D.	1000
Endrin	N.D.	1000
Endosulfan II	N.D.	1000
4,4'-DDD	N.D.	1000
Endosulfan Sulfate	N.D.	1000
4,4'-DDT	N.D.	1000
Endrin Ketone	N.D.	1000
Methoxychlor	N.D.	6000
Technical Chlordane	N.D.	6000
Toxaphene	N.D.	10000
A-1016	N.D.	6000
A-1221	N.D.	6000
A-1232	N.D.	6000
A-1242	N.D.	6000
A-1248	N.D.	6000
A-1254	N.D.	10000
A-1260	N.D.	10000

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498821
Sample Description: MW-6 5 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 498822
Sample Description: MW-6 10 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499917
Sample Description: B1 - Surface

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	9.
beta-BHC	N.D.	9.
delta-BHC	N.D.	9.
gamma-BHC (Lindane)	N.D.	9.
Heptachlor	N.D.	9.
Aldrin	N.D.	9.
Heptachlor Epoxide	N.D.	9.
Endosulfan I	N.D.	9.
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	90
Technical Chlordane	N.D.	90
Toxaphene	N.D.	200
A-1016	N.D.	90
A-1221	N.D.	90
A-1232	N.D.	90
A-1242	N.D.	90
A-1248	N.D.	90
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499918
Sample Description: B1 - 2 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499919
Sample Description: B1 - 5 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499920
Sample Description: B1 - 10 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499921
Sample Description: B2 - Surface

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	9.
beta-BHC	N.D.	9.
delta-BHC	N.D.	9.
gamma-BHC (Lindane)	N.D.	9.
Heptachlor	N.D.	9.
Aldrin	N.D.	9.
Heptachlor Epoxide	N.D.	9.
Endosulfan I	N.D.	9.
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	90
Technical Chlordane	N.D.	90
Toxaphene	N.D.	200
A-1016	N.D.	90
A-1221	N.D.	90
A-1232	N.D.	90
A-1242	N.D.	90
A-1248	N.D.	90
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499922
Sample Description: B2 - 2 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	30	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	30	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499923
Sample Description: B2 - 5 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	30
4,4'-DDE	N.D.	30
Endrin	N.D.	30
Endosulfan II	N.D.	30
4,4'-DDD	N.D.	30
Endosulfan Sulfate	N.D.	30
4,4'-DDT	N.D.	30
Endrin Ketone	N.D.	30
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	300
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	300
A-1260	N.D.	300

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499924
Sample Description: B2 - 10 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499925
Sample Description: B3 - Surface

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	9.
beta-BHC	N.D.	9.
delta-BHC	N.D.	9.
gamma-BHC (Lindane)	N.D.	9.
Heptachlor	N.D.	9.
Aldrin	N.D.	9.
Heptachlor Epoxide	N.D.	9.
Endosulfan I	N.D.	9.
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	90
Technical Chlordane	N.D.	90
Toxaphene	N.D.	200
A-1016	N.D.	90
A-1221	N.D.	90
A-1232	N.D.	90
A-1242	N.D.	90
A-1248	N.D.	90
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499926
Sample Description: B3 - 2 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499927
Sample Description: B3 - 5 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499928
Sample Description: B3 - 10 ft.

Priority Pollutants
Pesticides/PCB'S .

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	30
4,4'-DDE	N.D.	30
Endrin	N.D.	30
Endosulfan II	N.D.	30
4,4'-DDD	N.D.	30
Endosulfan Sulfate	N.D.	30
4,4'-DDT	N.D.	30
Endrin Ketone	N.D.	30
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	300
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	300
A-1260	N.D.	300

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499929
Sample Description: B4 - Surface

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499930
Sample Description: B4 - 2 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499931
Sample Description: B4 - 5 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: 499932
Sample Description: B4 - 10 ft.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	10
beta-BHC	N.D.	10
delta-BHC	N.D.	10
gamma-BHC (Lindane)	N.D.	10
Heptachlor	N.D.	10
Aldrin	N.D.	10
Heptachlor Epoxide	N.D.	10
Endosulfan I	N.D.	10
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	100
Technical Chlordane	N.D.	100
Toxaphene	N.D.	200
A-1016	N.D.	100
A-1221	N.D.	100
A-1232	N.D.	100
A-1242	N.D.	100
A-1248	N.D.	100
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Lab No: 503984
Sample Description: MW-I

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)	LOD (ug/L)
alpha-BHC	N.D.	0.05
beta-BHC	N.D.	0.05
delta-BHC	N.D.	0.05
gamma-BHC (Lindane)	N.D.	0.05
Heptachlor	N.D.	0.05
Aldrin	N.D.	0.05
Heptachlor Epoxide	N.D.	0.05
Endosulfan I	N.D.	0.05
Dieldrin	N.D.	0.10
4,4'-DDE	N.D.	0.10
Endrin	N.D.	0.10
Endosulfan II	N.D.	0.10
4,4'-DDD	N.D.	0.10
Endosulfan Sulfate	N.D.	0.10
4,4'-DDT	N.D.	0.10
Endrin Ketone	N.D.	0.10
Methoxychlor	N.D.	0.50
Technical Chlordane	N.D.	0.50
Toxaphene	N.D.	1.00
A-1016	N.D.	0.50
A-1221	N.D.	0.50
A-1232	N.D.	0.50
A-1242	N.D.	0.50
A-1248	N.D.	0.50
A-1254	N.D.	1.00
A-1260	N.D.	1.00

LOD = Limit of Detection.
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Lab No: 503985
Sample Description: MW-2

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)	LOD (ug/L)
alpha-BHC	N.D.	0.05
beta-BHC	N.D.	0.05
delta-BHC	N.D.	0.05
gamma-BHC (Lindane)	N.D.	0.05
Heptachlor	N.D.	0.05
Aldrin	N.D.	0.05
Heptachlor Epoxide	N.D.	0.05
Endosulfan I	N.D.	0.05
Dieldrin	N.D.	0.10
4,4'-DDE	N.D.	0.10
Endrin	N.D.	0.10
Endosulfan II	N.D.	0.10
4,4'-DDD	N.D.	0.10
Endosulfan Sulfate	N.D.	0.10
4,4'-DDT	N.D.	0.10
Endrin Ketone	N.D.	0.10
Methoxychlor	N.D.	0.50
Technical Chlordane	N.D.	0.50
Toxaphene	N.D.	1.00
A-1016	N.D.	0.50
A-1221	N.D.	0.50
A-1232	N.D.	0.50
A-1242	N.D.	0.50
A-1248	N.D.	0.50
A-1254	N.D.	1.00
A-1260	N.D.	1.00

LOD = Limit of Detection.
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Lab No: 503986
Sample Description: MW-3

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)	LOD (ug/L)
alpha-BHC	N.D.	0.05
beta-BHC	N.D.	0.05
delta-BHC	N.D.	0.05
gamma-BHC (Lindane)	N.D.	0.05
Heptachlor	N.D.	0.05
Aldrin	N.D.	0.05
Heptachlor Epoxide	N.D.	0.05
Endosulfan I	N.D.	0.05
Dieldrin	N.D.	0.10
4,4'-DDE	N.D.	0.10
Endrin	N.D.	0.10
Endosulfan II	N.D.	0.10
4,4'-DDD	N.D.	0.10
Endosulfan Sulfate	N.D.	0.10
4,4'-DDT	N.D.	0.10
Endrin Ketone	N.D.	0.10
Methoxychlor	N.D.	0.50
Technical Chlordane	N.D.	0.50
Toxaphene	N.D.	1.00
A-1016	N.D.	0.50
A-1221	N.D.	0.50
A-1232	N.D.	0.50
A-1242	N.D.	0.50
A-1248	N.D.	0.50
A-1254	N.D.	1.00
A-1260	N.D.	1.00

LOD = Limit of Detection.
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Lab No: S03987
Sample Description: MW-4

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)	LOD (ug/L)
alpha-BHC	N.D.	0.05
beta-BHC	N.D.	0.05
delta-BHC	N.D.	0.05
gamma-BHC (Lindane)	N.D.	0.05
Heptachlor	N.D.	0.05
Aldrin	N.D.	0.05
Heptachlor Epoxide	N.D.	0.05
Endosulfan I	N.D.	0.05
Dieldrin	N.D.	0.10
4,4'-DDE	N.D.	0.10
Endrin	N.D.	0.10
Endosulfan II	N.D.	0.10
4,4'-DDD	N.D.	0.10
Endosulfan Sulfate	N.D.	0.10
4,4'-DDT	N.D.	0.10
Endrin Ketone	N.D.	0.10
Methoxychlor	N.D.	0.50
Technical Chlordane	N.D.	0.50
Toxaphene	N.D.	1.00
A-1016	N.D.	0.50
A-1221	N.D.	0.50
A-1232	N.D.	0.50
A-1242	N.D.	0.50
A-1248	N.D.	0.50
A-1254	N.D.	1.00
A-1260	N.D.	1.00

LOD = Limit of Detection.
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Clayton Lab No: 502425
Sample Description: MW6-Pest.

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)	LOD (ug/L)
alpha-BHC	N.D.	0.05
beta-BHC	N.D.	0.05
delta-BHC	N.D.	0.05
gamma-BHC (Lindane)	N.D.	0.05
Heptachlor	N.D.	0.05
Aldrin	N.D.	0.05
Heptachlor Epoxide	N.D.	0.05
Endosulfan I	N.D.	0.05
Dieldrin	N.D.	0.10
4,4'-DDE	N.D.	0.10
Endrin	N.D.	0.10
Endosulfan II	N.D.	0.10
4,4'-DDD	N.D.	0.10
Endosulfan Sulfate	N.D.	0.10
4,4'-DDT	N.D.	0.10
Endrin Ketone	N.D.	0.10
Methoxychlor	N.D.	0.50
Technical Chlordane	N.D.	0.50
Toxaphene	N.D.	1.00
A-1016	N.D.	0.50
A-1221	N.D.	0.50
A-1232	N.D.	0.50
A-1242	N.D.	0.50
A-1248	N.D.	0.50
A-1254	N.D.	1.00
A-1260	N.D.	1.00

LOD = Limit of Detection.
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: M-Blank I (L/S)
Sample Description: Laboratory Soil Blank

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	8.
beta-BHC	N.D.	8.
delta-BHC	N.D.	8.
gamma-BHC (Lindane)	N.D.	8.
Heptachlor	N.D.	8.
Aldrin	N.D.	8.
Heptachlor Epoxide	N.D.	8.
Endosulfan I	N.D.	8.
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	80
Technical Chlordane	N.D.	80
Toxaphene	N.D.	200
A-1016	N.D.	80
A-1221	N.D.	80
A-1232	N.D.	80
A-1242	N.D.	80
A-1248	N.D.	80
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Clayton Project No: 36041-19
Clayton Lab No: M-Blank II (L/S)
Sample Description: Laboratory Soil Blank

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
alpha-BHC	N.D.	8.
beta-BHC	N.D.	8.
delta-BHC	N.D.	8.
gamma-BHC (Lindane)	N.D.	8.
Heptachlor	N.D.	8.
Aldrin	N.D.	8.
Heptachlor Epoxide	N.D.	8.
Endosulfan I	N.D.	8.
Dieldrin	N.D.	20
4,4'-DDE	N.D.	20
Endrin	N.D.	20
Endosulfan II	N.D.	20
4,4'-DDD	N.D.	20
Endosulfan Sulfate	N.D.	20
4,4'-DDT	N.D.	20
Endrin Ketone	N.D.	20
Methoxychlor	N.D.	80
Technical Chlordane	N.D.	80
Toxaphene	N.D.	200
A-1016	N.D.	80
A-1221	N.D.	80
A-1232	N.D.	80
A-1242	N.D.	80
A-1248	N.D.	80
A-1254	N.D.	200
A-1260	N.D.	200

LOD = Limit of Detection.
ND= Not Detected at LOD
LOD may vary due to weight of soil extracted and/or sample dilution
Endrin Ketone substituted for Endrin Aldehyde
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Lab No: Blank I
Sample Description: Water Blank

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)	LOD (ug/L)
alpha-BHC	N.D.	0.05
beta-BHC	N.D.	0.05
delta-BHC	N.D.	0.05
gamma-BHC (Lindane)	N.D.	0.05
Heptachlor	N.D.	0.05
Aldrin	N.D.	0.05
Heptachlor Epoxide	N.D.	0.05
Endosulfan I	N.D.	0.05
Dieldrin	N.D.	0.10
4,4'-DDE	N.D.	0.10
Endrin	N.D.	0.10
Endosulfan II	N.D.	0.10
4,4'-DDD	N.D.	0.10
Endosulfan Sulfate	N.D.	0.10
4,4'-DDT	N.D.	0.10
Endrin Ketone	N.D.	0.10
Methoxychlor	N.D.	0.10
Technical Chlordane	N.D.	0.50
Toxaphene	N.D.	0.50
A-1016	N.D.	1.00
A-1221	N.D.	0.50
A-1232	N.D.	0.50
A-1242	N.D.	0.50
A-1248	N.D.	0.50
A-1254	N.D.	0.50
A-1260	N.D.	1.00
	N.D.	1.00

LOD = Limit of Detection.
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Lab No: Blank II
Sample Description: Water Blank

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)	LOD (ug/L)
alpha-BHC	N.D.	0.10
beta-BHC	N.D.	0.10
delta-BHC	N.D.	0.10
gamma-BHC (Lindane)	N.D.	0.10
Heptachlor	N.D.	0.10
Aldrin	N.D.	0.10
Heptachlor Epoxide	N.D.	0.10
Endosulfan I	N.D.	0.10
Dieldrin	N.D.	0.10
4,4'-DDE	N.D.	0.20
Endrin	N.D.	0.20
Endosulfan II	N.D.	0.20
4,4'-DDD	N.D.	0.20
Endosulfan Sulfate	N.D.	0.20
4,4'-DDT	N.D.	0.20
Endrin Ketone	N.D.	0.20
Methoxychlor	N.D.	0.20
Technical Chlordane	N.D.	1.00
Toxaphene	N.D.	1.00
A-1016	N.D.	2.00
A-1221	N.D.	1.00
A-1232	N.D.	1.00
A-1242	N.D.	1.00
A-1248	N.D.	1.00
A-1254	N.D.	1.00
A-1260	N.D.	2.00
	N.D.	2.00

LOD = Limit of Detection.(May vary due to volume extracted and/or dilutions)
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Clayton Lab No: M-Blank I (L/W)
Sample Description: Laboratory Water Blank

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)	LOD (ug/L)
alpha-BHC	N.D.	0.05
beta-BHC	N.D.	0.05
delta-BHC	N.D.	0.05
gamma-BHC (Lindane)	N.D.	0.05
Heptachlor	N.D.	0.05
Aldrin	N.D.	0.05
Heptachlor Epoxide	N.D.	0.05
Endosulfan I	N.D.	0.05
Dieldrin	N.D.	0.10
4,4'-DDE	N.D.	0.10
Endrin	N.D.	0.10
Endosulfan II	N.D.	0.10
4,4'-DDD	N.D.	0.10
Endosulfan Sulfate	N.D.	0.10
4,4'-DDT	N.D.	0.10
Endrin Ketone	N.D.	0.10
Methoxychlor	N.D.	0.50
Technical Chlordane	N.D.	0.50
Toxaphene	N.D.	1.00
A-1016	N.D.	0.50
A-1221	N.D.	0.50
A-1232	N.D.	0.50
A-1242	N.D.	0.50
A-1248	N.D.	0.50
A-1254	N.D.	1.00
A-1260	N.D.	1.00

LOD = Limit of Detection.
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Lab No: MW-2
Sample Description: 503985 Matrix Spike

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)		LOD (ug/L)
alpha-BHC	N.D.		0.10
beta-BHC	N.D.		0.10
delta-BHC	N.D.		0.10
gamma-BHC (Lindane)	0.41	MS	0.10
Heptachlor	0.42	MS	0.10
Aldrin	0.40	MS	0.10
Heptachlor Epoxide	N.D.		0.10
Endosulfan I	N.D.		0.10
Dieldrin	1.01	MS	0.20
4,4'-DDE	N.D.		0.20
Endrin	1.08	MS	0.20
Endosulfan II	N.D.		0.20
4,4'-DDD	N.D.		0.20
Endosulfan Sulfate	N.D.		0.20
4,4'-DDT	1.04	MS	0.20
Endrin Ketone	N.D.		0.20
Methoxychlor	N.D.		1.00
Technical Chlordane	N.D.		1.00
Toxaphene	N.D.		2.00
A-1016	N.D.		1.00
A-1221	N.D.		1.00
A-1232	N.D.		1.00
A-1242	N.D.		1.00
A-1248	N.D.		1.00
A-1254	N.D.		2.00
A-1260	N.D.		2.00

LOD = Limit of Detection.(May vary due to volume extracted and/or dilutions)
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)
MS - Matrix spike compound: 0.4 ug/L - Lindane, Heptachlor, and Aldrin
1.0 ug/L - Dieldrin, Endrin, and 4,4'-DDT

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

Client Name: Cummins and Barnard, Inc.
Project No: 36041-19
Lab No: MW-2
Sample Description: 503985 Matrix Spike Duplicate

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)		LOD (ug/L)
alpha-BHC	N.D.		0.10
beta-BHC	N.D.		0.10
delta-BHC	N.D.		0.10
gamma-BHC (Lindane)	0.36	MSD	0.10
Heptachlor	0.37	MSD	0.10
Aldrin	0.37	MSD	0.10
Heptachlor Epoxide	N.D.		0.10
Endosulfan I	N.D.		0.10
Dieldrin	0.88	MSD	0.20
4,4'-DDE	N.D.		0.20
Endrin	0.90	MSD	0.20
Endosulfan II	N.D.		0.20
4,4'-DDD	N.D.		0.20
Endosulfan Sulfate	N.D.		0.20
4,4'-DDT	0.97	MSD	0.20
Endrin Ketone	N.D.		0.20
Methoxychlor	N.D.		1.00
Technical Chlordane	N.D.		1.00
Toxaphene	N.D.		2.00
A-1016	N.D.		1.00
A-1221	N.D.		1.00
A-1232	N.D.		1.00
A-1242	N.D.		1.00
A-1248	N.D.		1.00
A-1254	N.D.		2.00
A-1260	N.D.		2.00

LOD = Limit of Detection.(May vary due to volume extracted and/or dilutions)
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)
MS - Matrix spike compound: 0.4 ug/L - Lindane, Heptachlor, and Aldrin
1.0 ug/L - Dieldrin, Endrin, and 4,4'-DDT

APPENDIX F

VOLATILE ORGANIC ANALYSES (VOA)

INDEX OF SAMPLE RESULTS IN APPENDIX F
VOLATILE ORGANIC ANALYSES (VOA)

SAMPLE	SAMPLE MATRIX
MW-3 Surface	Soil
MW-3 2 Ft.	Soil
MW-3 5 Ft.	Soil
MW-3 10 Ft.	Soil
MW-4 Surface	Soil
MW-4 2 Ft.	Soil
MW-4 5 Ft.	Soil
MW-4 10 Ft.	Soil
MW-5 Surface	Soil
MW-5 2 Ft.	Soil
MW-5 5 Ft.	Soil
MW-5 10 Ft.	Soil
MW-6 Surface	Soil
MW-6 2 Ft.	Soil
MW-6 5 Ft.	Soil
MW-6 10 Ft.	Soil
B1 Surface	Soil
B1 2 Ft.	Soil
B1 5 Ft.	Soil
B1 10 Ft.	Soil
B2 Surface	Soil
B2 2 Ft.	Soil
B2 5 Ft.	Soil
B2 10 Ft.	Soil
B3 Surface	Soil
B3 2 Ft.	Soil
B3 5 Ft.	Soil
B3 10 Ft.	Soil
B4 Surface	Soil
B4 2 Ft.	Soil
B4 5 Ft.	Soil
MW1-HSL	Water
MW2-HSL	Water
MW3-HSL	Water
MW4-HSL	Water
MW5-HSL	Water
MW6-HSL	Water
Lab Blank L/S B5421	Soil
Lab Blank L/S B5482	Soil
Lab Blank L/S B5495	Soil
Lab Blank L/S B5511	Soil
Lab Blank L/S B5570	Soil
Lab Blank L/S B5579	Soil
B4 10 Ft. Matrix Spike	Soil
B4 10 Ft. Matrix Spike Duplicate	Soil

INDEX OF SAMPLE RESULTS IN APPENDIX F(cont.)
VOLATILE ORGANIC ANALYSES (VOA)

SAMPLE	SAMPLE MATRIX
MW-3 2 Ft. Matrix Spike	Soil
MW-3 2 Ft. Matrix Spike Duplicate	Soil
MW-6 10 Ft. Matrix Spike	Soil
MW-6 10 Ft. Matrix Spike Duplicate	Soil
Lab Blank L/W B5455	Water
Lab Blank L/W B5469	Water
Lab Blank L/W B5554	Water
Blank HSL	Water
MW5-HSL Matrix Spike	Water
MW5-HSL Matrix Spike Duplicate	Water
MW6-HSL Matrix Spike	Water
MW6-HSL Matrix Spike Duplicate	Water

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503499
File No.: 85571
Sample No.: MW-3 SURFACE

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	10
Chlorobenzene	ND	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	ND	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	ND	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	ND	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 14%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503499
File No.: 85571
Sample Id.: MW-3 SURFACE

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
<u>Volatile fraction</u>		
1-propanol	11.03	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503500
File No.: 85572
Sample No.: MW-3 2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	ND	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	ND	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	ND	5
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 15%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503500
File No.: 85572
Sample Id.: MW-3 2FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.91	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503501
File No.: 85573
Sample No.: MW-3 5FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 26%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503501
File No.: 85573
Sample Id.: MW-3 5FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.95	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503502
File No.: 85574
Sample No.: MW-3 10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 29%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503502
File No.: 85574
Sample Id.: MW-3 10FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.86	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498808
File No.: 85422
Sample No.: MW-4 SURFACE

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	ND	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	ND	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	ND	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	ND	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 9.9%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498808
File No.: B5422
Sample Id.: MW-4 SURFACE

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498809
File No.: 85423
Sample No.: MW-4 2 FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	46	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 26%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498809
File No.: 85423
Sample Id.: MW-4 2 FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
<u>Volatile fraction</u>		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498810
File No.: 85424
Sample No.: MW-4 5 FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	ND	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	ND	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	ND	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	ND	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 21%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498810
File No.: 85424
Sample Id.: MW-4 5 FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
No compounds detected.	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498811
File No.: 85425
Sample No.: MW-4 10 FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 25%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498811
File No.: 85425
Sample Id.: MW-4 10 FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503503
File No.: 85580
Sample No.: MW-5 SURFACE

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	ND	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	ND	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	ND	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	ND	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 11%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503503
File No.: 85580
Sample Id.: MW-5 SURFACE

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
no compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503504
File No.: 85581
Sample No.: MW 5-2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 24%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503504
File No.: 85581
Sample Id.: MW 5-2FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.93	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503505
File No.: 85582
Sample No.: MW 5-5FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	10	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 26%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503505
File No.: 85582
Sample Id.: MW 5-5FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.94	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503506
File No.: 85583
Sample No.: MW 5-10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 33%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503506
File No.: 85583
Sample Id.: MW 5-10FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.80	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498819
File No.: 85483
Sample No.: MW-6 SURFACE

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	ND	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	ND	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	38	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	ND	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	ND	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 18%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498819
File No.: 85483
Sample Id.: MW-6 SURFACE

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.27	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498820
File No.: B5484
Sample No.: MW-6 2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	13	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 32%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498820
File No.: B5484
Sample Id.: MW-6 2FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
hexane	18.70	8

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498821
File No.: 85485
Sample No.: MW-6 5FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 25%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498821
File No.: 85485
Sample Id.: MW-6 5FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.29	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498822
File No.: 85486
Sample No.: MW-6 10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	10	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 31%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498822
File No.: 85486
Sample Id.: MW-6 10FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.30	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499900
File No.: 85489
Sample Id.: B1-SURFACE

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	68	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 10%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499900
File No.: 85489
Sample Id.: B1-SURFACE

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
<u>Volatile fraction</u>		
1-propanol	10.24	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499901
File No.: 85490
Sample Id.: B1-2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	8
Bromodichloromethane	ND	8
Bromoform	ND	8
Bromomethane	ND	20
2-Butanone	ND	60
Carbon disulfide	ND	20
Carbon tetrachloride	ND	8
Chlorobenzene	ND	8
Chloroethane	ND	20
2-Chloroethylvinyl ether	ND	20
Chloroform	ND	8
Chloromethane	ND	20
Dibromochloromethane	ND	8
1,1-Dichloroethane	ND	8
1,2-Dichloroethane	ND	8
1,1-Dichloroethene	ND	8
trans-1,2-Dichloroethene	ND	8
1,2-Dichloropropane	ND	20
cis-1,3-Dichloropropene	ND	8
trans-1,3-Dichloropropene	ND	8
Ethyl benzene	ND	8
2-Hexanone	ND	20
Methylene chloride	ND	20
4-Methyl-2-pentanone	ND	20
Styrene	ND	8
1,1,2,2-Tetrachloroethane	ND	8
Tetrachloroethene	ND	8
Toluene	ND	8
1,1,1-Trichloroethane	ND	8
1,1,2-Trichloroethane	ND	8
Trichloroethene	ND	8
Vinyl acetate	ND	20
Vinyl chloride	ND	20
Xylenes (total)	ND	8

LOD = Limit of Detection ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 35%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499901
File No.: 85490
Sample Id.: B1-2FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.22	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499902
File No.: 85491
Sample Id.: B1-5FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 30%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499902
File No.: 85491
Sample Id.: 81-5FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.29	30
hexane	18.69	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499903
File No.: 85492
Sample Id.: B1-10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 26%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499903
File No.: 85492
Sample Id.: B1-10FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
no compounds found	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499904
File No.: 85497
Sample Id.: B2-SURFACE

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	ND	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	ND	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	34	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	ND	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	ND	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 10%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499904
File No.: 85497
Sample Id.: B2-SURFACE

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
unknown compound	8.06	9
1-propanol	10.47	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499905
File No.: 85498
Sample Id.: B2-2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 28%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499905
File No.: 85498
Sample Id.: B2-2FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.29	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499905
File No.: 85514
Sample Id.: B2-2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 28%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499905
File No.: 85514
Sample Id.: B2-2FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

APPENDIX G
RESULTS OF ANALYSES
FOR
EXPLOSIVES

TABLE 1 - EXPLOSIVES

Sample	Sample Matrix	RDX	2,4,6 TNT	2,6 DNT	2,4 DNT
MW-1	Water	<1.0 µg/L	<1.25 µg/L	<0.75 µg/L	<0.75 µg/L
MW-2	Water	<1.0 µg/L	<1.25 µg/L	<0.75 µg/L	<0.75 µg/L
MW-3	Water	<1.0 µg/L	<1.25 µg/L	<0.75 µg/L	<0.75 µg/L
MW-4	Water	<1.0 µg/L	<1.25 µg/L	<0.75 µg/L	<0.75 µg/L
MW-5	Water	<1.0 µg/L	<1.25 µg/L	<0.75 µg/L	<0.75 µg/L
MW-6	Water	<1.0 µg/L	<1.25 µg/L	<0.75 µg/L	<0.75 µg/L
MW-3	Soil	<0.98 µg/g	<1.92 µg/g	<0.40 µg/g	<0.42 µg/g
MW-4	Soil	<0.98 µg/g	<1.92 µg/g	<0.40 µg/g	<0.42 µg/g
MW-5	Soil	<0.98 µg/g	<1.92 µg/g	<0.40 µg/g	<0.42 µg/g
MW-6	Soil	<0.98 µg/g	<1.92 µg/g	<0.40 µg/g	<0.42 µg/g
B-1	Soil	<0.98 µg/g	<1.92 µg/g	<0.40 µg/g	<0.42 µg/g
B-2	Soil	<0.98 µg/g	<1.92 µg/g	<0.40 µg/g	<0.42 µg/g
B-3	Soil	<0.98 µg/g	<1.92 µg/g	<0.40 µg/g	<0.42 µg/g
B-4	Soil	<0.98 µg/g	<1.92 µg/g	<0.40 µg/g	<0.42 µg/g

WESTON ANALYTICS RESULTS SUMMARY   12 November 1986

NITROAROMATIC COMPOUNDS IN WATER
CLAYTON ENVIRONMENTAL   SAMPLES REC'D 10/23/86

All results reported as ug/L or ppb
Samples analyzed according to USATHAMA Method No. 8G including September, 1986 modifications

Weston ID #		HMX	RDX	1,3,5 7NB	1,3 DNB	NB	TETRYL	2,4,6 TNT	2,6 DNT	2,4 DNT
Detection Limits		1.75	1.0	0.75	0.75	0.75	1.00	1.25	0.75	0.75
10-081-0010	MW - 1	<	<	<	<	<	<	<	<	<
10-081-0020	MW - 2	<	<	<	<	<	<	<	<	<
10-081-0030	MW - 3	<	<	<	<	<	<	<	<	<
10-081-0040	MW - 4	<	<	<	<	<	<	<	<	<
10-081-0050	MW - 6	<	<	<	<	<	<	<	<	<
10-081-0060	502428	<	<	<	<	<	<	<	<	<

QA/QC RESULTS

Weston ID #		HMX	RDX	1.3.5 7NB	1,3 DNB	NB	TETRYL	2,4,6 TNT	2.6 DNT	2.4 DNT
Detection Limits		1.75	1.0	0.75	0.75	0.75	1.00	1.25	0.75	0.75
ab Blank		<	<	<	<	<	<	<	<	<
X spike		3.50	2.00	1.50	1.50	1.50	2.00	2.50	1.50	1.50
		(103)	(108)	(113)	(111)	(115)	(78.5)	(120)	(103)	(105)
X spike		17.5	10.0	7.50	7.50	7.50	10.0	12.5	7.50	7.50
		(97.1)	(99.6)	(110)	(107)	(79,0)	(105)	(93.6)	(77.6)	(87.4)
X spike		17.5	10.0	7.50	7.50	7.50	10.0	12.5	7.50	7.50
		(96.6)	(109)	(114)	(111)	(73.9)	(90.9	(97.6)	(101)	(102)
610-081-0060	502428	17.5	10.0	7.50	750	7.50	10.0	12.5	7.50	7.50
matrix spike		(89.1)	(120)	(98,8)	(108)	(90.9)	(72.8)	(86.4)	(91.4)	(93.9)

REPARED BY: Emily C Carfioli
Emily Carfioli
Data Manager
WESTON Analytical Laboratories

APPROVED BY: Carter M[illegible] For
Earl M. Hansen
Manager
WESTON Analytical Laboratories

'A.T'" ENV' '' .ENT''
WE..ON ANALYTI... SU....Y
NITROAROMATICS IN SOIL

Da.. .' Re. .. nbe. ..

entration (μg/g)*

Weston ID*	Client ID	HMX	RDX	1,3,5 TNB	1,3 DNB	NB	Tetryl	2,4,6 TNT	2,6 DNT	2,4 DNT
Detection Limit		1.27	0.98	2.09	0.59	0.42	0.32	1.92	0.40	0.42
610										
049-0010	MW 3	<	<	<	<	<	<	<	<	<
049-0020	MW 4	<	<	<	<	<	<	<	<	<
049-0030	MW 5	<	<	<	<	<	<	<	<	<
049-0040	MW 6	<	<	<	<	<	<	<	<	<
049-0050	B 1	<	<	<	<	<	<	<	<	<
049-0060	B 2	<	<	<	<	<	<	<	<	<
49-0070	B 3	<	<	<	<	<	<	<	<	<
49-0080	B 4	<	<	<	<	<	<	<	<	<
			<	<	<	<	<	<	<	<

<u>QA/AC SUMMARY</u>

All spikes reported as level spiked (% recovery)

		HMX	RDX	1,3,5 TNB	1,3 DNB	NB	Tetryl	2,4,6 TNT	2,6 DNT	2,4 DNT
Lab Blank	-	<	<	<	<	<	<	<	<	<
2X spike		2.05 (81)	1.56 (80)	3.33 (80)	0.99 (84)	0.82 (98)	0.30 (47)	3.37 (88)	0.60 (76)	0.67 (79)
0X spike		9.38 (74)	7.04 (72)	16.2 (78)	4.64 (79)	3.55 (85)	1.44 (45)	14.6 (76)	3.12 (78)	3.31 (79)
0X spike		9.78 (77)	7.45 (76)	16.9 (81)	4.84 (82)	3.48 (83)	2.35 (88)	15.8 (82)	3.26 (82)	3.58 (85)
0X matrix spike	MW 3	13.9 (86)	10.7 (88)	22.9 (88)	6.45 (89)	4.59 (85)	3.50 (45)	21.0 (88)	4.38 (90)	4.60 (91)

*All data reported on a dry weight basis.

PREPARED BY: Emily Capfioli
Emily Capfioli
Data Manager
WESTON Analytical Laboratories

APPROVED BY: Earl M. Hansen
Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

APPENDIX H

QUALITY ASSURANCE

PROJECT PLAN

Quality Assurance Project Plan
for
Child Development Center Site
Selfridge Air National Guard Base
Mt. Clemens, Michigan

under subcontract to Cummins & Barnard, Inc.

Approved and authorized by:

Project Manager: ______________________
James Bolger

Coordinator: ______________________
James Hampton

Laboratory Manager: ______________________
Robert Lieckfield, Jr.

Coordinator: ______________________
Daryl Strandbergh

Quality Assurance Coordinator: ______________________
John Spurr

November 17, 1986

Table of Contents

List of Figures

PROJECT DESCRIPTION

The following describes the quality assurance and quality control (QA/QC) practices to be used by Clayton Environmental Consultants, Inc. of Southfield, Michigan throughout the investigation of a specified site on the Selfridge Air National Guard Base (ANGB) in Mt. Clemens, Michigan. The site has been designated for construction of a child development center. Prior to beginning construction, the U.S. Army Corps of Engineers must determine that the soil and groundwater within the site boundaries are free of chemical contamination.

Characterization of the site will be done by Clayton, under subcontract to Cummins & Barnard, Inc. of Ann Arbor, Michigan. Well borings will be drilled at selected site locations by Keck Consulting Services, Inc. of Williamston, Michigan. Well placement was tentatively determined at a meeting held at Selfridge on August 21, 1986. Representatives of the U.S. Army Corps of Engineers, U.S. Army Environmental Hygiene Agency, Selfridge ANGB, Cummins & Barnard, and Clayton Environmental Consultants were present. Soil and water samples will be collected from the wells and analyzed by Clayton personnel to detect chemical contamination. All procedures will be performed in accordance with U.S. Environmental Protection Agency-approved methodology.

Within seven weeks of receiving authorization to begin work, Clayton will submit a draft report to Cummins Barnard and the Army summarizing the sampling, analysis, and interpretation of results. A final report will be submitted within 10 days of receipt of all comments.

PROJECT ORGANIZATION AND RESPONSIBILITY

Clayton's involvement in the project will be handled by two branches of the company - Waste Management Services and Laboratory Services. A project coordinator has been designated from each branch:

James Hampton - Waste Management Services
Daryl Strandbergh - Laboratory Services

Mr. Hampton will be responsible for the coordination of the project in whole. This will include arranging all field (sampling) activities, assimilating all laboratory results, and compiling the final project report. Mr. Strandbergh will be responsible for all laboratory analyses.

These two individuals will ensure that all aspects of the project are conducted in accordance with the project's QA/QC and work plans. Overall QA/QC will be under the supervision of the Quality Assurance Coordinator (QAC). The organizational structure of the laboratory is detailed in Figure 1.

QUALITY ASSURANCE PROGRAM

SAMPLING

Logs detailing well construction practices will be maintained for all drilling operations. Information in the logs shall include, but not be limited to, the following:

- Reference elevation for all depth measurements
- Depth of each change of stratum
- Thickness of each stratum
- Identification of the material of which each stratum is composed according to the United Soil Classification System
- Depth interval from which each sample was taken
- Depth at which groundwater is first encountered
- Depth to the static water level and changes in static water level with well depth
- Total depth of completed well

Sample collection and analysis will be performed in accordance with the scheme detailed in Figure 2. All sample information will be recorded on the sample bottle at the time of collection. A representative field blank will be included with each batch of samples collected.

All sampling equipment will be washed and rinsed between samples. Water samples will be collected with a Teflon bailer and filtered in the field.

All sample containers will be clean glass containers with Teflon lined lids. Bottles designated for each sample collection will contain appropriate preservatives before being taken to the sampling site. Water samples collected for the following analyses will require special preservation:

Metals - HNO_3 to pH<2 (2 milliliters/liter)
Cyanide - NaOH to pH>12 (4 pellets/liter)
Sulfide - NaOH to pH 9 (pellets/liter) + 2 mL zinc acetate

All samples will be stored at 4 °C once they arrive in the laboratory. There will be a maximum delivery time of 3 hours from field collection to the laboratory.

The need for sub-sampling or sample splitting will be avoided by using separate collection bottles in the field. Should the need arise, it will be handled directly by either the project or laboratory coordinator.

CUSTODY AND REVIEW

Custody logs (Figure 3) will begin at the time of sample collection. Custody is transferred when the samples are submitted to the laboratory for analysis.

The Laboratory Sample Custodian logs the samples into a computerized laboratory management system immediately upon arrival of the samples at Claytons' facility. Each sample is assigned a unique laboratory number. Information recorded includes client's name, Clayton project number, sample description, sampling media, analyses requested, and log-in date.

A Laboratory Analysis Report is printed in a standard format, detailing the analyses requested and any special instructions. All other pertinent documentation (Chain of Custody Record, Phone Logs, etc.) is kept with this Analysis Report as one package. These forms accompany the samples through the laboratory as they are analyzed.

All laboratory data is recorded in the chemist's laboratory notebook as it is produced. After the assigned chemist has analyzed the samples using the quality control practices specific to the method, the notebook is submitted to a second analyst for checking and review. After checking, the data is transferred to the Laboratory Analysis Report which is then submitted to the Technical Supervisor for review and approval.

Only after these reviews, will data be submitted for interpretation and inclusion into the final report.

ANALYTICAL

Standards

The accurate preparation of analytical standards and the control of their use in the analytical process is to be carried out as follows:

- o A computerized inventory of all "neat" compounds is maintained by the Standards Chemist. The record of each compound includes the following:

1. CAS number	6. Purity
2. Synonyms	7. Date received
3. Supplier	8. Volume or weight
4. Catalog	9. Chemical precautions
5. Lot number	10. Storage location

- o The Standards Chemist is responsible for reviewing all chemicals on an annual basis to determine which need to be disposed and reordered.

- o When a solution is prepared from neat material that is less than 96% pure, the concentration is corrected for its purity.

- Organic standard concentrations are verified by analyzing against standard solutions furnished by the U.S. EPA Quality Assurance Materials Bank. These reference solutions are stored near -20 °C. The two solutions must agree within $\pm$ 15% to have a validated concentration. All verification records, including chromatograms, are kept with the preparation records in the standard log books.

- Volatile Standards are prepared monthly; gas-phase volatiles weekly. Semi-volatile standards are prepared semi-annually.

- Inorganic standards are prepared weekly from primary stock solutions that are traceable to either NBS or EPA.

Equipment Performance Logs

An important part of Clayton's quality assurance program is to provide a detailed record of instrument performance and maintenance for all equipment and instruments used. These records are reviewed by the QAC.

Refrigerators/Freezers

- Each refrigerator and freezer contains only the items designated for that particular unit. Standard materials and sample types are completely segregated. This minimizes the possibility of cross-contamination.

- All units are monitored daily by assigned personnel. Temperatures are recorded daily in the log that is attached to the front of each unit. Refrigerators are held at 4 °C and freezers close to -20 °C.

Balances

- All analytical balances are checked weekly for calibration using a set of class "S" metric weights. Mettler balances are serviced annually.

- Records of the calibration checks are kept in a log book stored with each balance. Any service or maintenance performed on a balance is noted on a separate maintenance record in the logbook, then cross-referenced in the calibration record.

- If the error during the calibration check is greater than $\pm$ 1 of the last readable place, the balance must be recalibrated.

Reagent Water System

- Water purification is accomplished by a two-stage system. The "Millipore Milli-Q" system, providing Type I grade water, is preceded by a "Service D.I. Pretreatment" system which provides Type II grade water. When used in combination, 18 megohms/cm organic-free water is provided on demand at up to 1.5 liters per minute.

- The Type II water is used for the final rinsing of glassware while the Type I water is used for the preparation of aqueous standards, QC samples and method blanks.

- Method blanks and conductivity are monitored to ensure that the high purity of the laboratory water does not deviate and to ensure that no contamination is introduced during analytical procedures.

Instrument and Analyst Logbooks

- Instrument logs are kept to provide complete documentation of each analysis. Maintenance logs are kept on designated instruments. Analytical sequence logs are kept on all instruments by entering the sequence information into either the analyst's laboratory notebook or into a separate sequence log.

- Each analyst maintains a bound laboratory notebook containing all information regarding a particular analysis. All original data, calculations, and final results are recorded in these books along with the background information necessary to fully document how and when an analysis was performed.

Methods

All analytical methods to be used are U.S. EPA approved and published in readily available documents. Figure 4 details the specific method numbers to be used for each analysis. The source of each method may be determined by how the method is numbered. These are listed below:

Method Type	Method Source
xxx.x	"Methods for Chemical Analysis of Water and Wastes." U.S. EPA, EMSL, 26W. St. Clair St., Cincinnati, OH 45268. March, 1979. (EPA-600/4-79-20; Revised March, 1983).
xxxx	"Test Methods for Evaluating Solid Waste: Physical/Chemical Methods." U.S. EPA Office of Solid Waste and Emergency Response, Washington, D.C. 20460. 2nd ed., July, 1982. (SW-846, Revised April, 1984; with proposed additions, 1984).
CLP	"Statement of Work for Organics Analysis." U.S. EPA, Contract Laboratory Program protocol, revised July, 1985.
Army	USATHAMA Method No. 8G (Revised September, 1986.)

EP Toxicity leachate will be produced only if levels in the soil exceed 1/10 of the proposed RCRA TCLP regulatory levels or if levels in the water exceed 10 times the safe drinking water limits.

Since the decision to do EP Toxicity analysis is based on SWDA and RCRA permissible limits, it is important to ensure that analytical limits of detection (LODs) attainable are at or below these levels. Figure 5 details the LODs which will be reported for most analytes along with the regulated permissible concentrations.

All LODs for the multi-analyte methods (VOA, BNA, and Pesticides/PCB) are listed under each specific QC procedure.

ANALYTICAL QUALITY CONTROL

Quality Control in the laboratory is achieved by incorporating specific analytical quality control practices into the framework established by the general QA program. The use of appropriate methods and specific QC practices detailed within each method are critical to good quality.

QUALITY CONTROL PRACTICES

Clayton follows a basic set of policies regarding minimum quality control practices in the laboratory. If supplemental QC is needed, as specified in a particular method, it is done in addition to these basic measures.

- Instrumental conditions must meet predetermined specifications for sensitivity and linearity before samples are run.

- Quantitation is based on standards analyzed within each analytical run sequence. A minimum of three standards are run for linearity. When quantitation is based on linear regression, a minimum of five standard levels are run and a minimum correlation of .9990 must be met (.9950 for standard addition techniques).

- Instrumental detection limits (IDLs) are established as three times the standard deviation of the low level (method blank) background noise. A standard at, or below, this concentration is analyzed within each run. Sample limits of detection (LODs) will vary with the sample size, matrix, dilution, method recovery, and interferences.

- A minimum of one blank, or 5% of the number of samples, is processed and analyzed to monitor, and correct for, background levels or contamination.

- Duplicate matrix spikes, analyzed with every batch of 20 samples or less, are processed and analyzed to monitor accuracy and precision. These method recoveries must meet acceptance criteria when compared with established control limits.

CONTROL CHARTS

Data for all spiked matrix recoveries are monitored by using control charts for accuracy and precision. Use of control charts also provides for long term trend analysis. Data is reviewed in terms of meeting both method required acceptance criteria, and Clayton's internal acceptance limits.

A computerized system is used to produce Clayton's control limits (Figure 6) and monitor recoveries. Data is input as it is produced and checked for acceptability. These acceptance criteria are evaluated and updated quarterly. A summary table of all spiked compounds is produced with each new quarter's data and distributed for direct use by each analyst.

Duplicate recovery results must fall within control limits, based on 3 standard deviations (s) of historical results, to be acceptable. If they fall outside the 3s limits, all samples affected must be reanalyzed. After reanalysis, if they still fall outside these limits, all samples affected must be reprepared and analyzed again.

ORGANIC QC PROCEDURES

Volatile Organic Analysis (VOA) - CLP Protocol

- The 35 volatile compounds will be reported as shown in Figure 7.
- Gas chromatography/mass spectrometry (GC/MS) mass calibration and abundance pattern criteria must be demonstrated using p-bromofluorobenzene prior to each 12-hour period of analysis.
- A five-point initial calibration curve must demonstrate linearity through response factor stability by analyzing standards at 20, 50, 100, 150, and 200 ug/Liter.
- Continuing calibration must be demonstrated every 12 hours. Response factors obtained by running a 50-ug/L standard are compared to the average response factor of the initial curve.
- The following three surrogate standards are spiked into each sample prior to analysis:

Surrogate Compound	Recovery Limits (%) Water	Soil
toluene-d_8	88 - 110	81 - 117
4-bromofluorobenzene	86 - 115	74 - 121
1,2-dichloroethane-d_4	76 - 114	70 - 121

Surrogate spike recoveries must meet U.S. EPA established control limits for each compound.

- o The following three internal standards are spiked into each sample or standard at 50 ng/mL prior to analysis:

  bromochloromethane
  2,4-difluorobenzene
  chlorobenzene-d_5

  Quantitation of all identified compounds will be made using the appropriate internal standard and continuing calibration response factors.

- o A matrix spike and matrix spike duplicate (MS/MSD) analysis must be run with every batch of 20 samples or less (10%). MS/MSD recoveries and relative percent differences (RPD) should meet U.S. EPA established control limits for each compound. The following five compounds are spiked into a sample just prior to analysis:

Compound	Recovery Limits Water % (RPD)	Recovery Limits Soil % (RPD)
chlorobenzene	75-130 (13)	60-133 (21)
toluene	76-125 (13)	59-139 (21)
benzene	76-127 (11)	66-142 (21)
1,1-Dichloroethene	61-145 (14)	59-172(22)
trichloroethene	71-120 (14)	62-137 (24)

- o A method blank must be run with every batch of 20 samples or less (5%) or at least every 12 hours.

Semi-Volatile Analysis - CLP Protocol

- o The 65 Base Neutral Acid (BNA) compounds will be reported as shown in Figures 8 and 9.

- o GC/MS mass calibration and abundance pattern criteria must be demonstrated using decafluorotriphenylphosphine prior to each 12-hour period of analysis.

- o A five-point initial calibration curve must demonstrate linearity through response factor stability by analyzing standards at 20, 50, 80, 120, and 160 nanograms (ng).

- o Continuing calibration must be demonstrated every 12 hours. Response factors obtained by running a 50-ng standard are compared to the average response factor of the initial curve.

- o The following six surrogate standards are spiked into each sample prior to analysis:

Compound	Recovery Limits (%) Water	Soil
nitrobenzene-d_5	35-114	23-120
2-fluorobiphenyl	43-116	30-115
p-terphenyl-d_{14}	33-141	18-137
phenol-d_5	10-94	24-113
2-fluorophenol	21-100	25-121
2,4,6-tribromophenol	10-123	19-122

- Surrogate spike recoveries must meet U.S. EPA established control limits for each compound.

- The following six internal standards are spiked into each sample or standard at 40 ug/mL prior to analysis:

  1,4-dichlorobenzene-d_4
  naphthalene-d_8
  acenapthene-d_{10}
  phenanthrene-d_{10}
  chrysene-d_{12}
  perylene-d_{12}

  Quantitation of all identified compounds will be made using the appropriate internal standard and continuing calibration response factors.

- MS/MSD analysis must be run with every batch of 20 samples or less (10%). MS/MSD recoveries and relative percent differences (RPD) should meet U.S. EPA established control limits for each compound. The following 11 compounds are spiked into each sample just prior to extraction:

Compound	Recovery Limits Water % (RPD)	Soil % (RPD)
1,2,4-trichlorobenzene	39-98 (28)	38-107 (23)
acenaphthene	46-118 (31)	31-137 (19)
2,4-dinitrotoluene	24-96 (38)	28-89 (47)
pyrene	26-127 (31)	35-142 (36)
N-nitrosodi-n-propylamine	41-116 (38)	41-126 (38)
1,4-dichlorobenzene	36-97 (28)	28-104 (27)
pentachlorophenol	91-03 (50)	17-109 (47)
phenol	12-89 (42)	26-90 (35)
2-chlorophenol	27-123 (40)	25-102 (50)
4-chloro-3-methylphenol	23-87 (42)	26-103 (33)
4-nitrophenol	10-80 (50)	11-114 (50)

- A method blank must be extracted and analyzed with every batch of 20 samples or less (5%).

Pesticides and PCBs - CLP Protocol

- The 19 Pesticides and seven PCB Aroclors will be reported as shown in Figure 10.
- A three-point initial calibration curve must demonstrate linearity through response factor stability of aldrin, endrin, 4,4'-DDT, and dibutylchlorendate.
- Continuing calibration is checked every 10 analyses by response factor stability.
- Retention time windows for identification are established using standards within the analytical run.
- Degradation criteria for endrin and 4,4'-DDT must be met.
- Positive identification is confirmed by analysis on a second column.
- Dibutylchlorendate (DBC) is spiked into each sample prior to analysis. This surrogate spike recovery should meet U.S. EPA established control limits listed below.

Compound	Recovery Limits (%) Water	Soil
dibutylchlorendate	24-154	20-150

  The retention time of DBC for any given sample cannot shift by more than 2% from the initial calibration standards of the analysis.

- MS/MSD analysis must be run with every batch of 20 samples or less (10%). MS/MSD recoveries should meet U.S. EPA established control limits for each compound. The following six compounds are spiked into a sample just prior to extraction:

Compound	Recovery Limits Water % (RPD)	Soil % (RPD)
lindane	56-123 (15)	46-127 (50)
heptachlor	40-131 (20)	35-130 (31)
aldrin	40-120 (22)	34-132 (43)
dieldrin	52-126 (18)	31-134 (38)
endrin	56-121 (21)	42-139 (45)
4,4'-DDT	38-127 (27)	23-134 (50)

- One method blank must be run with every batch of 20 samples or less (5%)

EP Toxicity (Pesticides and Herbicides)

- A minimum of one blank is processed through the entire extraction, preparation, and analytical procedure for every batch of 20 samples or less.

- MS/MSD is carried through the entire leachate extraction procedure. MS/MSD recoveries must be run with every batch of 20 samples or less. The following five compounds are spiked into blank matrix:

  2,4-D
  2,4,5-TP (silvex)
  lindane
  endrin
  methoxychlor

- Three-point calibration curves are used to establish linearity of each analytical run.

- All compounds being quantitated must be on scale or within the range of linearity.

Total Hydrocarbons (as Hexane)

- Three point calibration curves are used to establish linearity of each analytical run.

- Continuing check standards are analyzed after every 10 samples. Percent differences (%D) cannot exceed 10%. If %D exceeds 10%, all samples affected must be rerun.

Explosives

- Analysis will be subcontracted to Roy F. Weston.

- Three explosives will be analyzed by GC and HPLC:

  TNT - trinitrotoluene
  DNT - dinitrotoluene
  RDX - cyclotrimethylene trinitramine

INORGANIC QC PROCEDURES

Metals (As, Ba, Cd, Cu, Pb, Hg, Cr, Se, Ag, and Zn)

- Digestion of all water, soil, or EP Toxicity leachate samples will be done using a mixture of nitric acid and hydrogen peroxide.

- Each water sample will be concentrated ten times during the initial digestion. A dried, pulverized portion of each soil sample will be concentrated after digestion and filtered before analysis. EP Toxicity leachate samples will be digested without a concentration step.

- All analyses are performed with the instrument meeting the manufacturer's sensitivity requirements.

- Quantitation of water and soil samples are made from linear regression curves of five standard levels that are analyzed throughout the sample run. A minimum correlation of .9990 must be obtained.

- Quantitation of EP Toxicity leachate samples are made using the standard addition of three levels of analyte into each sample. A minimum correlation of .9950 must be obtained.

- One blank will be analyzed with every batch of 20 samples or less (5%) and of similar matrix to monitor and correct for background levels or contamination.

- At least one sample from each batch of 10 or less (10%) will be digested and analyzed in duplicate.

- Duplicate matrix spikes (MS/MSD) will be analyzed with every batch of 20 samples or less (10%) to monitor method accuracy and precision. All analytes are spiked into reagent blank matrix just prior to digestion at a level that will fall around the midpoint of the standard curve. Results are compared with control chart limits for acceptability.

<u>Cyanide</u>

- Subcontracted to Spotts, Stevens and McCoy.

<u>Sulfide</u>

- One blank is analyzed with every batch of 20 samples or less (5%).

- MS/MSD analysis must be run with every batch of 20 samples or less (10%). Sodium sulfide is spiked into blank media at a concentration around the midpoint of the standard curve.

QUALITY ASSURANCE PERFORMANCE AUDITS

Quality Assurance in the laboratory is monitored by a combination of external and internal processes. Site inspections are conducted by the Clayton QAC as well as by governmental and private contractors at various frequencies.

Known QC "check" samples are analyzed quarterly to verify the accuracy of analytical procedures and to provide a method of spotting out-of-control analyses. These known samples come from a variety of sources but include "blind" spikes sent by clients as well as samples sent as part of interlaboratory studies. In addition, known QC samples are introduced internally for those analyses not covered by the previous two sources.

Historical records of all performance results are maintained to determine analytical trends or bias and to select target compounds to be tested internally.

EXTERNAL AUDITS

Interlaboratory quality assurance programs offer the best method of ensuring laboratory performance. The Clayton laboratory participates in nine different audit programs, three of which test water analysis.

The U.S. EPA Performance Evaluation Studies for Water Pollution and for Water Supply each occur semi-annually. Clayton participates in all four of these studies. In addition, the U.S. EPA conducts quarterly performance audits as part of the Contract Laboratory Program (CLP) for organics analyses. Recent results of these programs are included in Appendix L. The EPA also conducts semi-annual laboratory site visits to ensure that the high standard for laboratory practices is maintained.

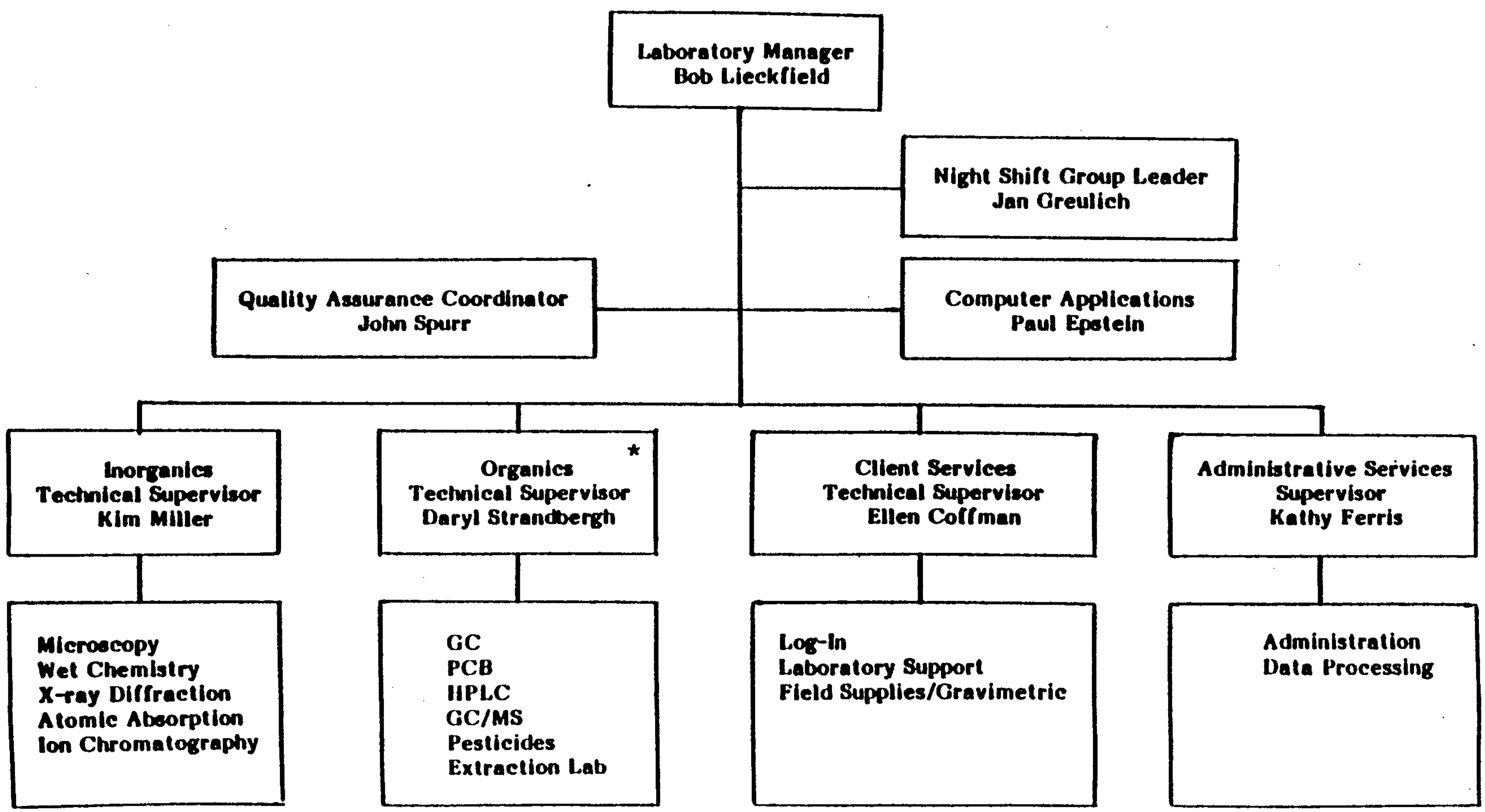
INTERNAL AUDITS

Clayton maintains its own intralaboratory performance audit program to supplement the interlaboratory program frequencies. Quality control samples of each analyte type are submitted quarterly for analysis - target compounds for organic analyses are varied with each audit. Samples are prepared by either spiking verified stock standards onto (into) blank media or obtained from Clayton's "bank" of QA samples furnished by the U.S. EPA Environmental Monitoring and Support Laboratory (EMSL). Prepared QC samples are then submitted "blind" as client samples.

FIGURE 1

Clayton Environmental Consultants, Inc.

Laboratory Organizational Chart



*Coordinator

FIGURE 2

Analytical Procedures by Sample Matrix and Location

Matrix/ No.of Spls.	VOA	Solvent Scan	Metals	PCB Pest.	BN/A	Expl.	CN /S	E.P. Tox
Surface soil-8	X	X	X	X		C		O
Soil @ 2ft.-8	X	X	X	X		C		O
Soil @ 5ft.-8	X	X	X	X		C		O
Soil @ 10ft.-8	X	X	X	X		C		O
Water-MW 1-6 (15 ft)	X	X	X	X	X	X		
Water-MW 3-6 (30 ft)	X	X	X	X	X	X	X	
Water-B 1-4 (30 ft)	X	X	X	X	X	X	X	

X - Analysis run on individual samples

O - Analysis run only if individual sample results exceed 10 times SDWA limit or 1/10 proposed RCRA limit

C - Analysis run on composite of boring

FIGURE 3

Clayton Environmental Consultants, Inc.

CHAIN OF CUSTODY RECORD

Client Name: ______________________
Clayton Job No.: ______________________
Laboratory Numbers: ______________________
Date Received by Laboratory: ______________________
Received by (Signature): ______________________
Condition of Samples: ______________________

Relinquished by (Signature): ______________________ Date/Time: __________
Purpose: ______________________
Received by (Signature): ______________________

Relinquished by (Signature): ______________________ Date/Time: __________
Purpose: ______________________
Received by (Signature): ______________________

Relinquished by (Signature): ______________________ Date/Time: __________
Purpose: ______________________
Received by (Signature): ______________________

Relinquished by (Signature): ______________________ Date/Time: __________
Purpose: ______________________
Received by (Signature): ______________________

Clayton Report Date: ______________________
Approved by (Signature): ______________________
Sample Storage Location: ______________________

Figure 4

Method References

	Water Method	Water H/T*	EP Leachate Method	EP Leachate H/T*	Soil Method	Soil H/T*
Organics						
VOA	CLP	14	—	—	CLP	14
BNA	CLP	6X;40	—	—	—	—
Pesticides/PCB	CLP	6X;40	—	—	CLP	11X;40
Total Hydrocarbons	418.1 (m)	—	—	—	9071 (m)	—
EP Toxicity	—	—	1310	—	—	—
Pesticides	—	—	8080	7X;30	—	—
Herbicides	—	—	8150	7X;30	—	—
Explosives	Army	—	—	—	Army	—
Inorganics						
Total Metals	200.0	—	1310	—	3050	—
Arsenic	206.2	180	7060	—	7061	—
Barium	208.1	180	7080	—	7080	—
Cadmium	213.1	180	7130	—	7130	—
Chromium	218.1	180	7190	—	7190	—
Copper	220.1	180	7210	—	7210	—
Lead	239.1	180	7420	—	7420	—
Mercury	245.1	28	7470	—	7471	—
Selenium	270.2	180	7740	—	7741	—
Silver	272.1	180	7760	—	7760	—
Zinc	289.1	180	7950	—	7950	—
Cyanide	335.3	14	—	—	—	—
Sulfide	376.1	7	—	—	—	—

*Maximum holding times agreed upon as days from sample receipt to analysis or extraction "X"

(m) Modified for analysis by GC/FID

Figure 5

Method Detection Levels

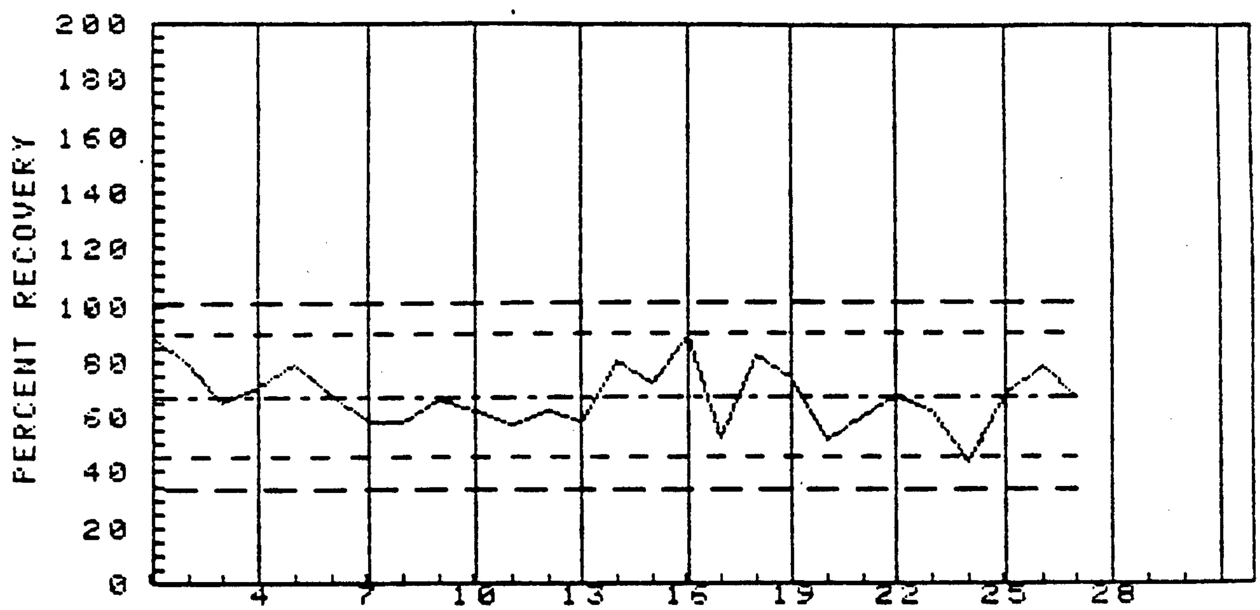
Matrix

	Water		EP Leachate		Soil	
	SDWA Limit (mg/L)	LOD (mg/L)	EP Tox Limit (mg/L)	LOD (mg/L)	TCLP Limit (mg/L)	LOD (mg/Kg)
Organics						
Total Trihalomethanes	0.10	0.005	—	—	—	0.005
Pesticides/Herbicides						
Endrin	0.0002	0.0001	0.02	—	0.003	0.02
Lindane	0.004	0.00005	0.4	—	0.06	0.008
Methoxychlor	0.1	0.0005	10.0	—	1.4	0.08
Toxaphene	0.005	0.001	0.5	—	0.07	0.2
2,4-D	0.1	—	10.0	—	1.4	—
2,4,5-TP	0.01	—	1.0	—	0.14	—
Total Hydrocarbons	—	4.	—	—	—	10.
Explosives						
RDX	—	0.001	—	—	—	1.
TNT	—	0.001	—	—	—	2.
DNT	—	0.0008	—	—	—	0.4
Inorganics						
Total Metals						
Arsenic	0.05	0.01	5.0	0.1	5.0	0.5
Barium	1.	0.05	100.	0.5	100.	10.
Cadmium	0.010	0.002	1.0	0.05	1.0	0.05
Chromium	0.05	0.02	5.0	0.5	5.0	0.5
Copper	1.	0.01	—	—	—	0.2
Lead	0.05	0.02	5.0	0.5	5.0	0.5
Mercury	0.002	0.0002	0.2	0.002	0.2	0.01
Selenium	0.01	0.01	1.0	0.1	1.0	0.1
Silver	0.05	0.005	5.0	0.1	5.0	0.1
Zinc	5.	0.003	—	—	—	0.08
Cyanide	—	0.01	—	—	—	—
Sulfide	—	1.	—	—	—	—

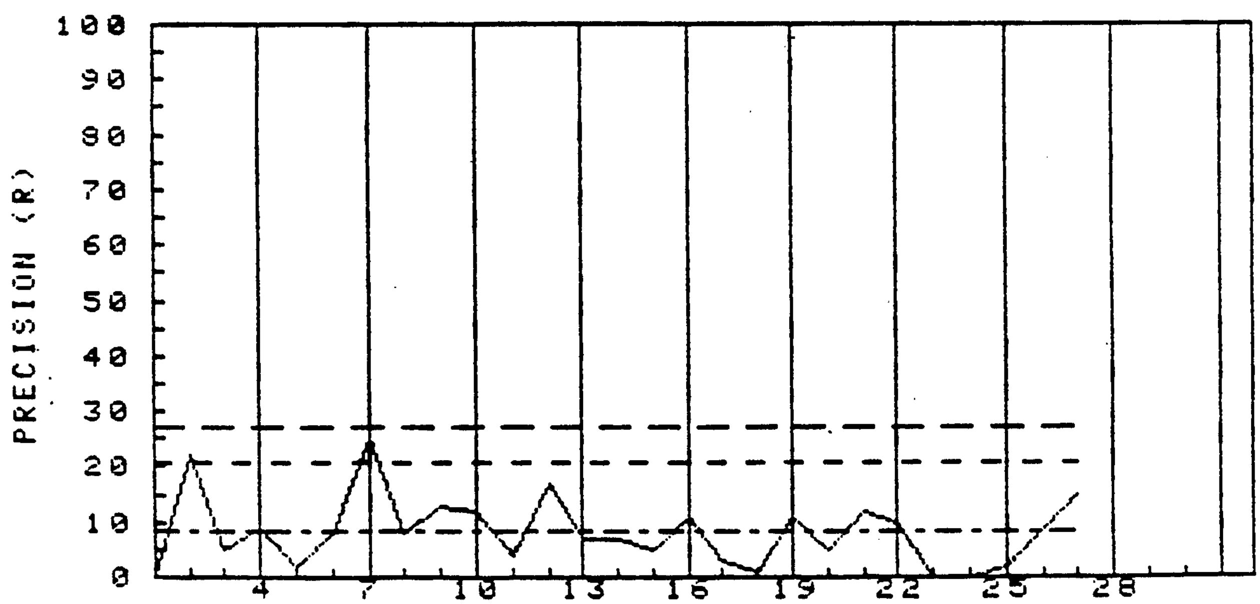
FIGURE 6

1,2,4-TRICHLOROBENZENE

MEDIUM: WATER METHOD: LOW



N	UCLX	UWLX	XBB	LWLX	LCLX
27	100.9	89.7	67.3	44.9	33.7



N	UCLR	UWLR	RBAR
27	27.0	20.7	8.3

FIGURE 7

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For:

Project No.:
Lab No.:
File No.:
Sample No.:

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)	LOD (ug/Kg)
Acetone	ND	90	90
Benzene	ND	5	5
Bromodichloromethane	ND	5	5
Bromoform	ND	5	5
Bromomethane	ND	10	10
2-Butanone	ND	40	40
Carbon disulfide	ND	10	10
Carbon tetrachloride	ND	5	5
Chlorobenzene	ND	5	5
Chloroethane	ND	10	10
2-Chloroethylvinyl ether	ND	10	10
Chloroform	ND	5	5
Chloromethane	ND	10	10
Dibromochloromethane	ND	5	5
1,1-Dichloroethane	ND	5	5
1,2-Dichloroethane	ND	5	5
1,1-Dichloroethene	ND	5	5
trans-1,2-Dichloroethene	ND	5	5
1,2-Dichloropropane	ND	10	10
cis-1,3-Dichloropropene	ND	5	5
trans-1,3-Dichloropropene	ND	5	5
Ethyl benzene	ND	5	5
2-Hexanone	ND	10	10
Methylene chloride	ND	10	10
4-Methyl-2-pentanone	ND	10	10
Styrene	ND	5	5
1,1,2,2-Tetrachloroethane	ND	5	5
Tetrachloroethene	ND	5	5
Toluene	ND	5	5
1,1,1-Trichloroethane	ND	5	5
1,1,2-Trichloroethane	ND	5	5
Trichloroethene	ND	5	5
Vinyl acetate	ND	10	10
Vinyl chloride	ND	10	10
Xylenes (total)	ND	5	5

LOD = Limit of Detection   ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

FIGURE 8

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for:

Project No.:
Lab No.:
File No.:
Sample Id.:

Base Neutral Compounds - Hazardous Substances List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acenaphthene	ND	10
Acenaphthylene	ND	10
Anthracene	ND	10
Benzo(a)anthracene	ND	10
Benzo(b)fluoranthene	ND	10
Benzo(k)fluoranthene	ND	10
Benzo(a)pyrene	ND	10
Benzo(ghi)perylene	ND	10
Benzyl alcohol	ND	10
Benzyl butyl phthalate	ND	10
Bis(2-chloroethyl)ether	ND	10
Bis(2-chloroethoxy)methane	ND	10
Bis(2-chloroisopropyl)ether	ND	10
Bis(2-ethylhexyl)phthalate	ND	20
4-Bromophenyl phenyl ether	ND	10
4-Chloroaniline	ND	10
2-Chloronaphthalene	ND	10
4-Chlorophenyl phenyl ether	ND	10
Chrysene	ND	10
Dibenzo(a,h)anthracene	ND	10
Dibenzofuran	ND	10
Di-n-butylphthalate	ND	10
1,2-Dichlorobenzene	ND	10
1,3-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
3,3'-Dichlorobenzidine	ND	20
Diethyl phthalate	ND	10
Dimethyl phthalate	ND	10
2,4-Dinitrotoluene	ND	10
2,6-Dinitrotoluene	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

FIGURE 9

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis for:

Project No.:
Lab No.:
File No.:
Sample Id.:

Acid Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Benzoic acid	ND	50
4-Chloro-3-methylphenol	ND	10
2-Chlorophenol	ND	10
2,4-Dichlorophenol	ND	10
2,4-Dimethylphenol	ND	10
2,4-Dinitrophenol	ND	50
2-Methyl-4,6-dinitrophenol	ND	50
2-Methylphenol	ND	10
4-Methylphenol	ND	10
2-Nitrophenol	ND	10
4-Nitrophenol	ND	50
Pentachlorophenol	ND	50
Phenol	ND	10
2,4,5-Trichlorophenol	ND	50
2,4,6-Trichlorophenol	ND	10

LOD - Limit of Detection

ND - Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

FIGURE 10

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
Analytical Laboratory Report

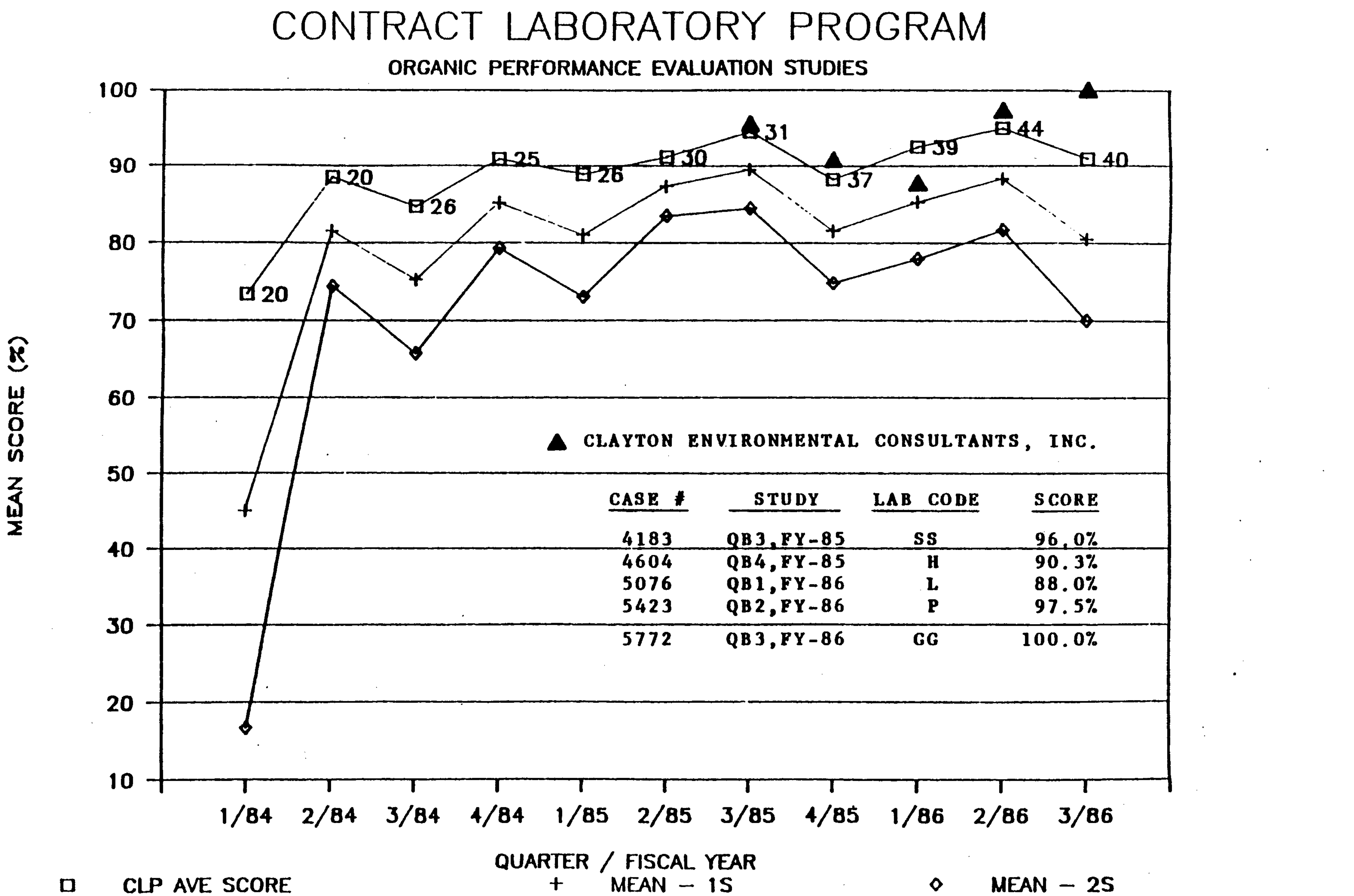
Client Name:
Project No:
Lab No:
Sample Description:

Priority Pollutants
Pesticides/PCB'S

Compounds	CONCENTRATION (ug/L)	LOD (ug/L)	LOD (ug/Kg)
alpha-BHC	N.D.	0.05	8.
beta-BHC	N.D.	0.05	8.
delta-BHC	N.D.	0.05	8.
gamma-BHC (Lindane)	N.D.	0.05	8.
Heptachlor	N.D.	0.05	8.
Aldrin	N.D.	0.05	8.
Heptachlor Epoxide	N.D.	0.05	8.
Endosulfan I	N.D.	0.05	8.
Dieldrin	N.D.	0.10	20
4,4'-DDE	N.D.	0.10	20
Endrin	N.D.	0.10	20
Endosulfan II	N.D.	0.10	20
4,4'-DDD	N.D.	0.10	20
Endosulfan Sulfate	N.D.	0.10	20
4,4'-DDT	N.D.	0.10	20
Endrin Ketone	N.D.	0.10	20
Methoxychlor	N.D.	0.50	80
Technical Chlordane	N.D.	0.50	80
Toxaphene	N.D.	1.00	200
A-1016	N.D.	0.50	80
A-1221	N.D.	0.50	80
A-1232	N.D.	0.50	80
A-1242	N.D.	0.50	80
A-1248	N.D.	0.50	80
A-1254	N.D.	1.00	200
A-1260	N.D.	1.00	200

LOD = Limit of Detection.
ND= Not Detected at LOD
METHOD: Anlysis performed by gas chromatography/
electron capture detector (GC/ECD)

APPENDIX I



CONTRACT LABORATORY PROGRAM
ORGANIC PERFORMANCE EVALUATION STUDIES
MEAN SCORE (%)
100
90
80
70
60
50
40
30
20
10
20
20
26
25
26
30
31
37
39
44
40
1/84
2/84
3/84
4/84
1/85
2/85
3/85
4/85
1/86
2/86
3/86
QUARTER / FISCAL YEAR
CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
CASE # STUDY LAB CODE SCORE
4183 QB3,FY-85 SS 96.0%
4604 QB4,FY-85 H 90.3%
5076 QB1,FY-86 L 88.0%
5423 QB2,FY-86 P 97.5%
5772 QB3,FY-86 GG 100.0%
CLP AVE SCORE
MEAN – 1S
MEAN – 2S

PERFORMANCE EVALUATION REPORT DATE: 06/03/86

WATER POLLUTION STUDY NUMBER WP016

LABORATORY: MI033

PARAMETERS	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
TRACE METALS IN MICROGRAMS PER LITER:						
ALUMINUM	1	1920	2129	1780.-2430.	1860.-2350.	ACCEPTABLE
	2	672	700	557.- 850.	594.- 813.	ACCEPTABLE
ARSENIC	1	300	342	244.- 419.	266.- 397.	ACCEPTABLE
	2	185	191	131.- 244.	145.- 230.	ACCEPTABLE
BERYLLIUM	1	235	291	246.- 326.	256.- 316.	NOT ACCEPTABLE
	2	622	661	564.- 749.	588.- 725.	ACCEPTABLE
CADMIUM	1	328	307	269.- 348.	279.- 338.	ACCEPTABLE
	2	129	119.3	105.- 134.	108.- 131.	ACCEPTABLE
COBALT	1	915	953	783.-1090.	822.-1050.	ACCEPTABLE
	2	196	210	176.- 244.	184.- 235.	ACCEPTABLE
CHROMIUM	1	278	274	213.- 331.	227.- 316.	ACCEPTABLE
	2	715	686	534.- 826.	571.- 790.	ACCEPTABLE
COPPER	1	386	380	332.- 422.	344.- 411.	ACCEPTABLE
	2	790	749	657.- 830.	679.- 809.	ACCEPTABLE
IRON	1	1280	1311	1120.-1480.	1170.-1440.	ACCEPTABLE
	2	630	633	538.- 722.	561.- 699.	ACCEPTABLE
MERCURY	1	45.4	50.0	34.4- 65.9	38.3- 61.9	ACCEPTABLE
	2	7.10	15.0	10.1- 20.7	11.4- 19.4	NOT ACCEPTABLE
MANGANESE	1	510	510	448.- 564.	463.- 550.	ACCEPTABLE
	2	155	150	129.- 169.	134.- 164.	ACCEPTABLE
NICKEL	1	570	532	460.- 605.	479.- 587.	ACCEPTABLE
	2	1440	911	791.-1030.	821.-1000.	NOT ACCEPTABLE
LEAD	1	116	118.8	89.0- 146.	96.1- 139.	ACCEPTABLE
	2	830	851	706.- 984.	740.- 949.	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

PERFORMANCE EVALUATION REPORT DATE: 06/03/86

WATER POLLUTION STUDY NUMBER WP016

LABORATORY: MI033

PARAMETERS	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
MINERALS IN MILLIGRAMS PER LITER: (EXCEPT AS NOTED)						
TDS AT 180 C	1	342	330	234.- 418.	257.- 395.	ACCEPTABLE
	2	88.9	70.0	39.2- 106.	47.5- 97.4	ACCEPTABLE
TOTAL HARDNESS (AS CACO3)	1	169	168	153.- 180.	157.- 177.	ACCEPTABLE
	2	25.2	26.1	21.9- 30.1	22.9- 29.0	ACCEPTABLE
CALCIUM	1	35.7	36.0	31.0- 40.4	32.1- 39.2	ACCEPTABLE
	2	9.30	9.80	8.20- 11.3	8.59- 10.9	ACCEPTABLE
MAGNESIUM	1	19.5	19.0	15.8- 21.8	16.5- 21.0	ACCEPTABLE
	2	0.479	0.400	.289- .497	.315- .471	CHECK FOR ERROR
SODIUM	1	24.5	25.1	21.9- 28.7	22.7- 27.8	ACCEPTABLE
	2	10.2	9.90	8.29- 11.5	8.69- 11.1	ACCEPTABLE
POTASSIUM	1	26.0	25.0	20.0- 28.7	21.1- 27.6	ACCEPTABLE
	2	8.95	8.00	6.34- 9.39	6.72- 9.00	ACCEPTABLE
TOTAL ALKALINITY (AS CACO3)	1	23.0	26.0	21.8- 29.4	22.8- 28.5	ACCEPTABLE
	2	12.6	12.0	8.51- 16.0	9.44- 15.1	ACCEPTABLE
CHLORIDE	1	121	119	109.- 128.	111.- 126.	ACCEPTABLE
	2	18.6	18.5	15.4- 21.5	16.1- 20.8	ACCEPTABLE
FLUORIDE	1	1.16	1.30	1.08- 1.49	1.13- 1.44	ACCEPTABLE
	2	0.23	0.397	.319- .489	.341- .468	NOT ACCEPTABLE
SULFATE	1	57.1	55.0	43.7- 65.3	46.4- 62.6	ACCEPTABLE
	2	22.2	18.0	13.9- 21.6	14.9- 20.6	NOT ACCEPTABLE
PCB'S IN MICROGRAMS PER LITER:						
PCB-AROCLOR 1232	1	4.39	4.98	2.23- 6.43	2.77- 5.90	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

PERFORMANCE EVALUATION REPORT DATE: 06/03/86

WATER POLLUTION STUDY NUMBER WP016

LABORATORY: MI033

PARAMETERS	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
VOLATILE HALOCARBONS IN MICROGRAMS PER LITER:						
CHLOROFORM	1	6.62	6.04	3.27- 8.55	3.95- 7.87	ACCEPTABLE
	2	84.3	84.5	57.1- 118.	63.8- 103.	ACCEPTABLE
1,1,1 TRICHLOROETHANE	1	16.0	14.8	10.2- 20.7	11.5- 19.4	ACCEPTABLE
	2	49.9	44.3	28.0- 62.5	32.3- 58.2	ACCEPTABLE
TRICHLOROETHENE	1	21.8	22.5	14.0- 30.0	16.0- 27.9	ACCEPTABLE
	2	105	100.2	58.8- 137.	68.5- 127.	ACCEPTABLE
CARBONTETRACHLORIDE	1	20.1	18.5	11.1- 26.0	13.0- 24.1	ACCEPTABLE
	2	62.7	52.9	33.0- 76.2	38.4- 70.8	ACCEPTABLE
TETRACHLOROETHENE	1	17.8	16.9	10.6- 22.5	12.1- 21.0	ACCEPTABLE
	2	86.6	84.7	51.3- 109.	58.5- 102.	ACCEPTABLE
BROMODICHLOROMETHANE	1	16.1	15.6	10.8- 21.2	12.1- 19.8	ACCEPTABLE
	2	73.8	65.7	44.4- 92.9	50.5- 86.8	ACCEPTABLE
DIBROMOCHLOROMETHANE	1	20.0	19.1	11.5- 28.9	13.7- 26.7	ACCEPTABLE
	2	106	95.6	64.7- 142.	74.4- 132.	ACCEPTABLE
BROMOFORM	1	50.3	50.6	28.1- 75.1	34.8- 69.2	ACCEPTABLE
	2	32.0	30.4	14.5- 49.0	18.8- 44.7	ACCEPTABLE
METHYLENE CHLORIDE	1	12.8	20.5	10.8- 30.0	13.2- 27.6	CHECK FOR ERROR
	2	47.2	63.8	30.6- 93.0	38.4- 85.2	ACCEPTABLE
CHLOROBENZENE	1	29.8	29.4	20.2- 38.1	22.5- 35.8	ACCEPTABLE
	2	68.3	67.8	46.1- 91.6	51.8- 85.9	ACCEPTABLE
VOLATILE AROMATICS IN MICROGRAMS PER LITER:						
BENZENE	1	84.2	83.0	46.5- 119.	55.6- 110.	ACCEPTABLE
	2	32.9	25.9	17.3- 34.7	19.5- 32.4	CHECK FOR ERROR

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

PERFORMANCE EVALUATION REPORT DATE: 07/11/86

WATER SUPPLY STUDY NUMBER WS019

LABORATORY MI033

ANALYTES	SAMPLE NUMBER	REPORTED VALUE		TRUE VALUE*	ACCEPTANCE LIMITS	PERFORMANCE EVALUATIONS
ALL VALUES IN MICROGRAMS PER LITER (EXCEPT AS NOTED)						
ARSENIC	1	17.2		15.0	11.4- 18.4	ACCEPTABLE
	2	139		90.0	72.5- 104.	NOT ACCEPTABLE
BARIUM	1	196		189	156.- 235.	ACCEPTABLE
	2	277		315	260.- 353.	ACCEPTABLE
CADMIUM	1	40.4	**	45.0	33.7- 48.7	ACCEPTABLE
	2	4.60	**	5.00	3.63- 5.63	ACCEPTABLE
CHROMIUM	1	27.3		27.5	23.1- 32.1	ACCEPTABLE
	2	75.2		77.1	66.1- 87.9	ACCEPTABLE
LEAD	1	25.6		23.8	18.7- 28.8	ACCEPTABLE
	2	362		85.0	69.2- 98.2	NOT ACCEPTABLE
MERCURY	1	.85		0.325	.537- 1.16	ACCEPTABLE
	2	2.95		3.58	2.55- 4.49	ACCEPTABLE
SELENIUM	1	157		95.7	70.1- 115.	NOT ACCEPTABLE
	2	11.4		15.4	11.8- 19.5	NOT ACCEPTABLE
SILVER	1	17.3		16.0	12.8- 19.5	ACCEPTABLE
	2	39.1		36.0	29.7- 42.4	ACCEPTABLE
NITRATE AS N (MILLIGRAMS PER LITER)	1	0.37		0.444	.355- .542	ACCEPTABLE
	2	9.46		9.37	8.22- 10.4	ACCEPTABLE
FLUORIDE (MILLIGRAMS PER LITER)	1	.301		0.531	.474- .577	NOT ACCEPTABLE
	2	1.32		1.38	1.25- 1.48	ACCEPTABLE
ENDRIN	1	0.29		0.330	.193- .449	ACCEPTABLE
	2	2.1		2.80	1.72- 3.55	ACCEPTABLE
LINDANE	1	0.24		0.170	.0667- .239	NOT ACCEPTABLE
	2	3.4	**	4.20	2.24- 5.30	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

** SIGNIFICANT GENERAL METHOD BIAS IS ANTICIPATED FOR THIS RESULT.

PERFORMANCE EVALUATION REPORT DATE: 07/11/86

WATER SUPPLY STUDY NUMBER WS018

LABORATORY MI033

ANALYTES	SAMPLE NUMBER	REPORTED VALUE		TRUE VALUE*	ACCEPTANCE LIMITS	PERFORMANCE EVALUATIONS
ALL VALUES IN MICROGRAMS PER LITER (EXCEPT AS NOTED)						
1,2DIBROMO3CHLOROPROPANE	1	0.56		3.40	.318- 6.03	ACCEPTABLE
	2	1.80		11.3	3.35- 16.3	NOT ACCEPTABLE ←
1,2 DIBROMOETHANE	1	1.2		1.73	1.01- 2.35	ACCEPTABLE
	2	2.96		6.93	4.06- 9.13	NOT ACCEPTABLE ←
TOLUENE	3	2.12		1.66	1.18- 2.38	ACCEPTABLE
	4	10.7		11.6	8.71- 14.9	ACCEPTABLE
ETHYLBENZENE	3	1.09		1.26	.698- 1.85	ACCEPTABLE
	4	5.56		6.29	4.35- 8.52	ACCEPTABLE
CHLOROBENZENE	3	1.14		1.33	.614- 1.90	ACCEPTABLE
	4	7.70		8.58	5.66- 11.8	ACCEPTABLE
STYRENE	3	2.18		2.43	1.83- 2.89	ACCEPTABLE
	4	10.5		12.2	9.19- 14.8	ACCEPTABLE
1,2 DICHLOBENZENE	3	1.33		1.77	1.09- 2.42	ACCEPTABLE
	4	6.76		7.58	5.30- 9.68	ACCEPTABLE
TOTAL FILTERABLE RESIDUE (MILLIGRAMS PER LITER)	1	228	**	249	147.- 433.	ACCEPTABLE
CALCIUM (MG. CACO3/L)	1	116		124	109.- 136.	ACCEPTABLE
PH-UNITS	1	9.01		9.04	8.74- 9.35	ACCEPTABLE
ALKALINITY (MG. CACO3/L)	1	38.0	**	36.9	33.9- 42.8	ACCEPTABLE
SODIUM (MILLIGRAMS PER LITER)	1	18.5		16.9	15.0- 19.1	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.
** SIGNIFICANT GENERAL METHOD BIAS IS ANTICIPATED FOR THIS RESULT.

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499909
File No.: 85502
Sample Id.: 83-2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	ND	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	ND	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	ND	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	ND	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 20%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499909
File No.: 85502
Sample Id.: B3-2FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.39	9

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499910
File No.: 85503
Sample Id.: B3-5FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 25%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499910
File No.: 85503
Sample Id.: B3-5FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.34	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499911
File No.: 85504
Sample Id.: 83-10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	200
Benzene	ND	8
Bromodichloromethane	ND	8
Bromoform	ND	8
Bromomethane	ND	20
2-Butanone	ND	70
Carbon disulfide	ND	20
Carbon tetrachloride	ND	8
Chlorobenzene	ND	8
Chloroethane	ND	20
2-Chloroethylvinyl ether	ND	20
Chloroform	ND	8
Chloromethane	ND	20
Dibromochloromethane	ND	8
1,1-Dichloroethane	ND	8
1,2-Dichloroethane	ND	8
1,1-Dichloroethene	ND	8
trans-1,2-Dichloroethene	ND	8
1,2-Dichloropropane	ND	20
cis-1,3-Dichloropropene	ND	8
trans-1,3-Dichloropropene	ND	8
Ethyl benzene	ND	8
2-Hexanone	ND	20
Methylene chloride	ND	20
4-Methyl-2-pentanone	ND	20
Styrene	ND	8
1,1,2,2-Tetrachloroethane	ND	8
Tetrachloroethene	ND	8
Toluene	ND	8
1,1,1-Trichloroethane	ND	8
1,1,2-Trichloroethane	ND	8
Trichloroethene	ND	8
Vinyl acetate	ND	20
Vinyl chloride	ND	20
Xylenes (total)	ND	8

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 41%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499908
File No.: 85501
Sample Id.: B3-SURFACE

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
unknown compound	8.14	10
1-propanol	10.37	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499908
File No.: 85501
Sample Id.: 83-SURFACE

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	ND	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	ND	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	51	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	ND	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	ND	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 13%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499907
File No.: 85500
Sample Id.: B2-10FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.30	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499907
File No.: 85500
Sample Id.: B2-10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 29%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499906
File No.: 85499
Sample Id.: B2-5FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.30	30

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499906
File No.: 85499
Sample Id.: 82-5FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	8
Bromodichloromethane	ND	8
Bromoform	ND	8
Bromomethane	ND	20
2-Butanone	ND	60
Carbon disulfide	ND	20
Carbon tetrachloride	ND	8
Chlorobenzene	ND	8
Chloroethane	ND	20
2-Chloroethylvinyl ether	ND	20
Chloroform	ND	8
Chloromethane	ND	20
Dibromochloromethane	ND	8
1,1-Dichloroethane	ND	8
1,2-Dichloroethane	ND	8
1,1-Dichloroethene	ND	8
trans-1,2-Dichloroethene	ND	8
1,2-Dichloropropane	ND	20
cis-1,3-Dichloropropene	ND	8
trans-1,3-Dichloropropene	ND	8
Ethyl benzene	ND	8
2-Hexanone	ND	20
Methylene chloride	ND	20
4-Methyl-2-pentanone	ND	20
Styrene	ND	8
1,1,2,2-Tetrachloroethane	ND	8
Tetrachloroethene	ND	8
Toluene	ND	8
1,1,1-Trichloroethane	ND	8
1,1,2-Trichloroethane	ND	8
Trichloroethene	ND	8
Vinyl acetate	ND	20
Vinyl chloride	ND	20
Xylenes (total)	ND	8

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 37%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499911
File No.: 85504
Sample Id.: 83-10FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.31	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499912
File No.: 85505
Sample Id.: B4-SURFACE

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 26%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499912
File No.: B5505
Sample Id.: B4-SURFACE

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.32	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499913
File No.: 85506
Sample Id.: B4-2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	18	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 24%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499913
File No.: 85506
Sample Id.: 84-2FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.39	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499914
File No.: 85507
Sample Id.: B4-5FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 26%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499914
File No.: B5507
Sample Id.: B4-5FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.33	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499915
File No.: 85508
Sample Id.: B4-10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	ND	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	ND	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	ND	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	ND	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	ND	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 28%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499915
File No.: 85508
Sample Id.: B4-10FT.

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.31	20

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500832
File No.: 85465
Sample No.: MW1-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500832
File No.: 85465
Sample Id.: MW1-HSL

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
<u>Volatile fraction</u>		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500831
File No.: 85463
Sample No.: MW2-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500831
File No.: 85463
Sample Id.: MW2-HSL

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
<u>Volatile fraction</u>		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500829
File No.: 85461
Sample No.: MW3-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500829
File No.: 85461
Sample Id.: MW3-HSL

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500830
File No.: 85462
Sample No.: MW4-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500830
File No.: 85462
Sample Id.: MW4-HSL

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Volatile fraction		
methylcyclopentane	14.75	90
hexane	18.71	70

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 502423
File No.: 85555
Sample Id.: MWS-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at or above LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 502423
File No.: 85555
Sample Id.: MW5-HSL

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Volatile fraction		
No compounds detected.	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500833
File No.: 85470
Sample No.: MW6-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500833
File No.: 85470
Sample Id.: MW6-HSL

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85421
Sample No.: LAB BLANK L/S

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 0%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85421
Sample Id.: LAB BLANK L/S

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85482
Sample Id.: LAB BLANK L/S

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 0%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85482
Sample Id.: LAB BLANK L/S

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
hexane	18.71	10

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85495
Sample Id.: LAB BLANK L/S

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 0%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85495
Sample Id.: M-BLANK L/S

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
1-propanol	10.36	9

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85511
Sample Id.: LAB BLANK L/S

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 0%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85511
Sample Id.: M-BLANK L/S

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
no compounds found	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: B5570
Sample No.: LAB BLANK L/S

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 0%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: B5570
Sample Id.: LAB BLANK L/S

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD. INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85579
Sample No.: LAB BLANK L/S

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 0%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85579
Sample Id.: LAB BLANK L/S

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/Kg)
Volatile fraction		
no compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499915 matrix spike
File No.: 85512
Sample Id.: B4-10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	69 ms	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	68 ms	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	76 ms	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	71 ms	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	60 ms	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 28%
ms - Matrix spike compound, 69 ug/Kg added.
Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 499915 matrix spike duplicate
File No.: 85513
Sample Id.: B4-10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	65 ms	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	64 ms	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	79 ms	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	68 ms	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	58 ms	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at or above LOD

ms - Matrix spike compound, 69 ug/Kg added.
ug/Kg - Results calculated on dry weight basis. Moisture = 28%

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503500 matrix spike
File No.: 85575
Sample No.: MW 3-2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	66 ms	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	60 ms	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	69 ms	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	10	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	60 ms	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	61 ms	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 15%
Analysis performed by gas chromatography/mass spectrometry (GC/MS).
ms - Matrix spike compound, 59 ug/Kg added.

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 503500 matrix spike duplicate
File No.: 85576
Sample No.: MW 3-2FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/Kg)
Acetone	ND	100
Benzene	75 ms	6
Bromodichloromethane	ND	6
Bromoform	ND	6
Bromomethane	ND	10
2-Butanone	ND	50
Carbon disulfide	ND	10
Carbon tetrachloride	ND	6
Chlorobenzene	73 ms	6
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	6
Chloromethane	ND	10
Dibromochloromethane	ND	6
1,1-Dichloroethane	ND	6
1,2-Dichloroethane	ND	6
1,1-Dichloroethene	85 ms	6
trans-1,2-Dichloroethene	ND	6
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	6
trans-1,3-Dichloropropene	ND	6
Ethyl benzene	ND	6
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	6
1,1,2,2-Tetrachloroethane	ND	6
Tetrachloroethene	ND	6
Toluene	77 ms	6
1,1,1-Trichloroethane	ND	6
1,1,2-Trichloroethane	ND	6
Trichloroethene	69 ms	6
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	6

LOD = Limit of Detection ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 15%
Analysis performed by gas chromatography/mass spectrometry (GC/MS).
ms - Matrix spike compound, 59 ug/Kg added.

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498822 matrix spike
File No.: 85487
Sample No.: MW-6 10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/kg)
Acetone	ND	100
Benzene	70 ms	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	71 ms	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	77 ms	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	10	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	70 ms	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	62 ms	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 31%
ms - Matrix spike compound, 72 ug/Kg added.
Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 498822 matrix spike duplicate
File No.: 85488
Sample No.: MW-6 10FT.

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/Kg)	LOD (ug/kg)
Acetone	ND	100
Benzene	67 ms	7
Bromodichloromethane	ND	7
Bromoform	ND	7
Bromomethane	ND	10
2-Butanone	ND	60
Carbon disulfide	ND	10
Carbon tetrachloride	ND	7
Chlorobenzene	63 ms	7
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	7
Chloromethane	ND	10
Dibromochloromethane	ND	7
1,1-Dichloroethane	ND	7
1,2-Dichloroethane	ND	7
1,1-Dichloroethene	57 ms	7
trans-1,2-Dichloroethene	ND	7
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	7
trans-1,3-Dichloropropene	ND	7
Ethyl benzene	ND	7
2-Hexanone	ND	10
Methylene chloride	10	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	7
1,1,2,2-Tetrachloroethane	ND	7
Tetrachloroethene	ND	7
Toluene	61 ms	7
1,1,1-Trichloroethane	ND	7
1,1,2-Trichloroethane	ND	7
Trichloroethene	55 ms	7
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	7

LOD = Limit of Detection   ND = Not Detected at LOD

ug/Kg - Results calculated on dry weight basis. Moisture = 31%
ms - Matrix spike compound, 72 ug/Kg added.
Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85455
Sample No.: LAB BLANK L/W

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85455
Sample Id.: LAB BLANK L/W

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85469
Sample No.: LAB BLANK L/W

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85469
Sample Id.: LAB BLANK L/W

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85554
Sample Id.: LAB BLANK L/W

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection ND = Not Detected at or above LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: ------
File No.: 85554
Sample Id.: M-BLANK L/W

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500834
File No.: 85464
Sample No.: BLANK-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	ND	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	ND	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	ND	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500834
File No.: 85464
Sample Id.: BLANK-HSL

Tentatively Identified Compounds

COMPOUND NAME	RT (min)	ESTIMATED CONCENTRATION (ug/L)
Volatile fraction		
No compounds detected	--	--

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 502423 matrix spike
File No.: 85556
Sample Id.: MWS-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	52 ms	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	56 ms	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	66 ms	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	56 ms	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	45 ms	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at or above LOD

ms - Matrix spike compound, 50 ug/L added.
Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 502423 matrix spike duplicate
File No.: 85557
Sample Id.: MWS-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	54 ms	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	49 ms	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	54 ms	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	53 ms	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	45 ms	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at or above LOD

ms - Matrix spike compound, 50 ug/L added.
Analysis performed by gas chromatography/mass spectrometry (GC/MS).

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500833 matrix spike
File No.: 85471
Sample No.: MW6-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	59 ms	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	56 ms	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	61 ms	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	59 ms	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	57 ms	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection ND = Not Detected at LOD

Analysis performed by gas chromatography/mass spectrometry (GC/MS).

ms - Matrix spike compound, 50 ug/L added.

CLAYTON ENVIRONMENTAL CONSULTANTS INC.

Results of Analysis For: CUMMINS AND BARNARD, INC.

Project No.: 36041-19
Lab No.: 500833 matrix spike duplicate
File No.: 85472
Sample No.: MW6-HSL

Volatile Compounds - Hazardous Substance List

COMPOUND NAME	CONCENTRATION (ug/L)	LOD (ug/L)
Acetone	ND	90
Benzene	61 ms	5
Bromodichloromethane	ND	5
Bromoform	ND	5
Bromomethane	ND	10
2-Butanone	ND	40
Carbon disulfide	ND	10
Carbon tetrachloride	ND	5
Chlorobenzene	55 ms	5
Chloroethane	ND	10
2-Chloroethylvinyl ether	ND	10
Chloroform	ND	5
Chloromethane	ND	10
Dibromochloromethane	ND	5
1,1-Dichloroethane	ND	5
1,2-Dichloroethane	ND	5
1,1-Dichloroethene	59 ms	5
trans-1,2-Dichloroethene	ND	5
1,2-Dichloropropane	ND	10
cis-1,3-Dichloropropene	ND	5
trans-1,3-Dichloropropene	ND	5
Ethyl benzene	ND	5
2-Hexanone	ND	10
Methylene chloride	ND	10
4-Methyl-2-pentanone	ND	10
Styrene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	57 ms	5
1,1,1-Trichloroethane	ND	5
1,1,2-Trichloroethane	ND	5
Trichloroethene	57 ms	5
Vinyl acetate	ND	10
Vinyl chloride	ND	10
Xylenes (total)	ND	5

LOD = Limit of Detection   ND = Not Detected at LOD

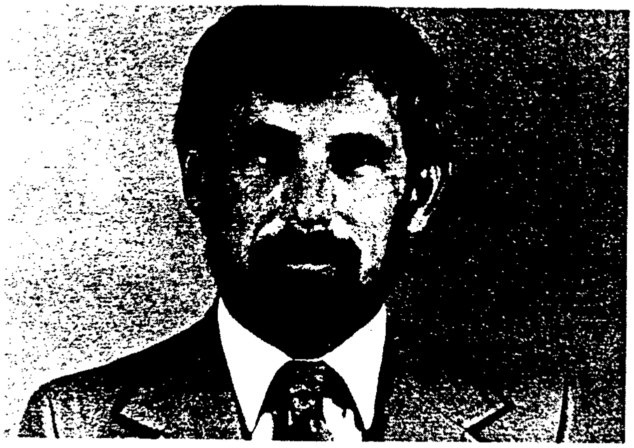
Analysis performed by gas chromatography/mass spectrometry (GC/MS).

ms - Matrix spike compound, 50 ug/L added.

APPENDIX D

PROFESSIONAL PROFILES OF KEY WESTON PERSONNEL

4191B



Peter J. Marks

Fields of Competence

Project management; environmental analytical laboratory analysis; hazardous waste, groundwater and soil contamination; source emissions/ambient air sampling; wastewater treatment; biological monitoring methods; and environmental engineering.

Experience Summary

Twenty-three years in environmental laboratory and environmental engineering as Project Scientist, Project Engineer, Process Development Supervisor, and Manager of Environmental Laboratory. Experience in analytical laboratory, wastewater surveys, hazardous waste, groundwater and soil contamination, DoD-specific wastes, stream surveys, process develop ment studies, and source emission and ambient air testing. In-depth experience in pulp and paper, steel, organic chemicals, pharmaceutical, glass, petroleum, petrochemical, metal plating, food industries and DoD. Applied research on a number of advanced wastewater treatment projects funded by U.S. EPA.

Credentials

B.S., Biology—Franklin and Marshall College (1963)

M.S., Environmental Engineering and Science—Drexel University (1965)

American Society for Testing and Materials

Water Pollution Control Federation

Water Pollution Control Association of Pennsylvania

Employment History

1965-Present	WESTON
1963-1964	Lancaster County General Hospital Research Laboratory for Analytical Methods Development

Key Projects

USAF/OEHL Brooks AFB. Program Manager for this three-year BOA contract provides technical support in environmental engineering surveys, wastewater characterization programs, geological investigations, hydrogeological studies, landfill leachate monitoring and landfill siting investigations, bioassay studies, wastewater and hazardous waste treatability studies, and laboratory testing and/or field investigations of environmental instrumentation/equipment. Collection, analysis, and reporting of contaminants present in water and wastewater samples in support of Air Force Environmental Health Programs.

United States Army Toxic and Hazardous Materials Agency (USATHAMA), Aberdeen Proving Ground, Maryland. Program Manager for three-year basic ordering agreement contract to provide research and development for technology in support of the DOD Installation Restoration Program. The objective of the Program is to identify and develop treatment methods/technology for containment and/or remedial action. Technology development for remedial action is to include groundwater, soils, sediments, and sludges.

Confidential Client, Pennsylvania. Program Manager for permitting and design of a major solid waste landfill.

Confidential Client (Inorganic and Organic Chemicals). Product Manager of a contract to conduct wastewater sampling and analysis of plant effluent for priority pollutants. The project also includes a wastewater treatability study to evaluate a number of process alternatives for removal of priority pollutants from the present effluent.

Confidential Client. Program Manager for ongoing 10-year contract to evaluate fate and effect of various chemicals in the environment. Testing includes biotoxicity, biodegradability in various media using radiolabeled compounds, and absorption/desorption studies. Between 100 and 200 compounds are tested annually.

In conjunction with the University of Delaware, WESTON analyzed more than 500 biological and marine sediment samples for 11 constituent trace metals as part of a program to identify and trace the migration of metals from ocean dumping of sludges on the continental shelf off the coast of the State of Delaware. Acted as Technical Project Manager.

Project Manager in charge of a wastewater analysis and biological treatability project for industrial client for the identification and degradation of six pesticide-containing wastewaters.

Professional Profile

U.S. EPA Environmental Monitoring and Support Laboratory. Multi-year contract to provide reference laboratory analysis on QA/QC samples produced from the U.S. EPA Analytical Laboratory QA/QC program.

Publications

"Microbiological Inhibition Testing Procedure," Biological Methods for the Assessment of Water Quality, A.S.T.M. Publication STP 528.

"Heat Treatment of Waste Activated Sludge" (with V.T. Stack).

"Biological Monitoring in Activated Sludge Treatment Process," a joint paper with Stover/Woldman.

Katherine A. Sheedy

Fields of Competence

Geologic investigation and site evaluation; environmental impact assessment, quantitative and qualitative groundwater analysis, design of groundwater monitoring systems.

Experience Summary

Nine years experience in geological investigations including environmental impact analysis in geology, groundwater, and soils; hydrogeologic investigations of hazardous waste sites, preparation and delivery of expert testimony; assessment and mitigation of low-level radioactive contamination of groundwater and soils; migration of low-level radioactive contamination of groundwater and soils; migration of radionuclides in groundwater; site stability in limestone terrains; development of evaluation criteria for site search and selection projects; pre-mine opening hydrologic investigations for surface and underground coal mines; development of clean-up strategies for hazardous and radioactive waste disposal sites; Environmental Impact Statement preparation and review; site suitability investigations of waste disposal facilities for industrial and residential developments.

Credentials

B.A.—Queens College, CUNY (1969)

M.S., Geology—University of Delaware (1975)

American Geophysical Union

Geological Society of America

National Water Well Association, Technical Division

Employment History

1974-Present	WESTON
1972-1974	University of Delaware

Key Projects

Preparation of RCRA Part B permit application for facilities in the Midwest and on the West coast.

Initial Assessment Studies to identify possible contamination resulting from past practices at military installations.

Assessment of groundwater contamination from a municipal landfill in the Atlantic Coastal Plain including aquifer simulation to determine migration 10, 20 and 30 years in the future.

Hydrogeologic assessment of a multi-source military installation. The project includes groundwater modeling for the installation and for areas outside the installation in conjunction with State and Federal agencies.

Design of monitoring systems for a large industrial complex in Montana.

Assessment of regulatory requirements for hazardous waste lagoon closure in over forty states.

Assessment and analysis of emerging trends in groundwater research as applied to the utility industry.

Preparation of EPA Remedial Action Master Plans for five uncontrolled hazardous waste sites.

Principal investigator for geology, soils and groundwater portion of an Environmental Impact Statement for the decontamination of a radioactive waste disposal site in Canonsburg, Pennsylvania.

Project manager and principal investigator on clean-up of a site contaminated by pharmaceutical wastes in New Jersey.

Project manager and principal investigator for assistance in EIS preparation for five synthetic fuel plants in east-central United States.

Evaluation of environmental impact and operation of 23 municipal landfills in the Atlantic Coastal Plain.

Hydrogeologic investigations at mine sites prior to, during and after mining operations in Illinois.

Hydrogeologic investigations to determine site suitability for landfills, sewage sludge disposal, spray irrigation and industrial waste disposal.

Principal investigator on a dredge material disposal site feasibility study for Interstate Division for Baltimore City. This project was conducted to evaluate the feasibility of specific sites for disposal of 5 million cubic yards of

Professional Profile

material dredged from the Fort McHenry Tunnel in Baltimore. The evaluation included examination of costs, engineering feasibility, site stability, impact on biology and groundwater and ultimate use of the site as an inner-city park.

Supervision of an investigation to determine groundwater quality, delineate the extent of groundwater pollution and develop a groundwater-quality management program for a six-county area. Evaluated the adequacy of existing groundwater-quality standards and interacted with regulatory agencies.

Evaluation of groundwater quality, quantity and facilities; impact on groundwater for sites in semi-arctic environments and within the Columbia River Basin Project area.

Environmental assessment for a 200,000-BPCD refinery on a semi-arid island with extensive groundwater use in the West Indies.

Evaluation of structural stability problems in limestone solution area in Pennsylvania.

Supervision of a leachate collection system and groundwater monitoring program for an industrial landfill.

Investigation of potential sources of petroleum product found to be discharging through the subsurface, at the shore of Lake Erie.

Development of a state-of-the-art study and environmental analysis of the geothermal steam industry.

Publications

Sheedy, K. A., 1979, "Three-Phase Approach to Determination of Site Stability in Limestone". Presented at Association of Engineering Geologists 1979 Annual Meeting, Chicago, Illinois.

Sheedy, K. A., Schoenberger, R. J., Haderer, P., Dovey, R., 1979, "Solid Waste Disposal in the Coastal Plain: A Case Study." Presented at Association of Engineering Geologists 1979 Annual Meeting, Chicago, Illinois.

Sheedy, K. A., Leis, W., Thomas, A., 1980, "Land Use in Limestone Terrain, Problems and Case Study Solutions". In *Applied Geomorphology*, (The "Binghamton" symposia; 11) George Allen and Unwin, 1982.

Sheedy, K. A., Leis, W. Bopp, F., Anderson, J., "Use of Ground Penetrating Radar in Limestone Terrain". American Geographers Association, 1981.

Sheedy, K. A., "Methodology for the Selection of Low-Level Radioactive Waste Disposal Sites". American Nuclear Society, 1982.

Christopher W. Krumm

Fields of Competence

Hydrogeologic investigations; assessment of organic and inorganic soil and groundwater contamination; environmental sampling of groundwater, surface water, soil and sediments; analytical chemistry; instrumental analysis of inorganic and organic compounds; petrographic analysis; detection of heavy metals contamination of groundwater and surface water; evaluation of waste contamination or mineralization by geochemistry of soils, sediments, groundwater, and surface water.

Experience Summary

Two years experience in applied hydrogeology, including supervision and installation of environmental monitoring systems; environmental soil, sediment, surface water and groundwater sample collection; environmental data evaluation and management; and hydrogeological site characterizations.

Ten years experience as a quality control analytical chemist in the chemical industry. Experienced with manufacture, purification, and detection of organic and inorganic compounds. Monitored air and water quality and solid waste by-products around chemical plant property. Research experience included the study of a disseminated ore prospect in granitic formations and unconsolidated soils.

Credentials

B.A., Geology and Chemistry—Capital University, Columbus, Ohio (1975)

M.S., Geology and Mineralogy—Ohio State University (1984)

American Chemical Society

Association of Exploration Geochemists

National Water Well Association

Employment History

1986-Present	WESTON
1977-1986	ASARCO, Inc.
1975-1977	Chemical Samples Company

Key Projects

Site supervisor for the installation and sampling of comprehensive environmental monitoring projects which included soil borings; deep and shallow monitoring wells; geophysical well logging; surface geophysical surveys (GPR and electromagnetic); test pit excavation; soil gas surveys; borehole and surface soil sampling; groundwater sampling; surface water sampling; and hydraulic conductivity testing, such as slug and pump tests.

Conducted and participated in environmental assessments of properties for clients participating in real estate transactions.

Participated in environmental sampling of groundwater monitoring wells, surface water, soil borings, surface soils and test pit excavations.

Helped design and implement a data collection and management system using portable and mainframe computers.

Defined the extent and magnitude of groundwater and surface contamination by heavy metals in and around ASARCO, Inc. Zinc Oxide plant in Columbus, Ohio.

Assisted in project to establish statistical product control procedures in ASARCO Zinc Oxide plant operations.

Participated in research projects for the American Society for Testing and Materials for development of ASTM standard procedures.

Evaluated the soil geochemistry of a molybdenum-copper ore prospect near Tonopah, Nevada (Master's Thesis).

Professional Profile

William L. Niemann

Fields of Competence

Geologic and hydrogeologic investigations; supervision of soil borings and monitoring well installation; soil, groundwater, and surface water sampling; compilation and analysis of detailed geologic and hydrogeologic data; preparation of written summaries and evaluations of field activities and hydrogeologic and geologic data.

Experience Summary

Over one year experience in geologic and hydrogeologic investigations, including groundwater monitoring well installation and sampling at industrial sites and U.S. military installations.

Assessed groundwater and soil contamination data from industrial sites, and prepared written recommendations for remedial actions. Performed a series of aquifer drawdown tests for an industrial client. Prepared RCRA Part B permit applications for hazardous waste storage facilities.

Credentials

B.S.S., History—Cornell College (1981)

B.S., Geology—Southern Illinois University (1983)

M.S., Geology—University of Iowa (1986)

Association of Groundwaters Scientists and Engineers

Employment History

1987-Present	WESTON
1986-1987	Wang Engineering, Inc.

Key Projects

Participated in extensive, multisite hydrogeologic investigation of a 3,000-acre U.S. Air Force base. Activities included soil borings, groundwater monitoring well installation, and single-well permeability testing. Prepared written summary of drilling program and participated in development of computer program to calculate hydraulic conductivity values from single-well permeability test data.

Conducted pre-closure soil contamination assessments, and prepared written reports containing clean-up recommendations for small sites run by a major U.S. solvent manufacturer/recycler.

Performed a series of aquifer drawdown tests at an industrial site to determine optimal placement and pumping rate of additional wells installed as part of a remedial groundwater treatment program.

Participated in groundwater sampling of 124 groundwater monitoring wells and an aquifer drawdown test at a U.S. Army ammunition plant.

Prepared RCRA Part B permit applications for hazardous waste storage facilities. Activities included site visits and interaction with various state and local governmental officials and agencies.

Produced computer-generated contour maps of chemical contamination data as part of a remedial investigation at an Illinois EPA site.

Professional Profile

JON D. OLANDER

Fields of Competence

Geologic and hydrologic investigations installation of groundwater monitoring systems; techniques for the collection of groundwater, surface water, soil and sediment samples; compilation and evaluation of detailed geologic and hydrologic data; computer modeling for analyses and interpretation of hydrogeologic conditions, collection of water level data using continuous water level recorders.

Experience Summary

Over one year of experience in geologic and hydrogeologic investigations including investigation at landfill sites, waste disposal and spill sites at a U.S. Air Force Installation and U.S. EPA sites. Supervisor of drilling program for multiple site groundwater monitoring system. Assessment of groundwater, surface water and soil contamination for recommendation of remedial actions. Applied computer modeling to analyses of groundwater aquifers.

Credentials

B.S., Geology--Iowa State University (1982)

M.S., Geology--Iowa State University (1987)

Association of Groundwater Scientists and Engineers, NWWA

American Geophysical Union

Geological Society of America

Employment History

1987 - Present	WESTON
1983 - 1987	Iowa State University, Department of Earth Sciences

Key Projects

Conducted hydrogeologic investigation for U.S. Air Force Installation Restoration Program Phase II. Supervised and performed field investigation of waste disposal and spill sites related to base activities. Field activities included installation of 41 monitoring wells, environmental sampling of groundwater, surface water and soil, hydraulic conductivity testing and continuous water level monitoring.

Performed ground penetrating radar survey as part of a real estate assessment for a confidential client.

Conducted permeability testing of limestone bedrock using single packer and dual-packer systems and the installation of a piezometer network.

Performed oversight activities of a sediment sampling program at a Superfund site. Maintained daily logs of all activities performed and the methods that were used.

Gregory S. Kinsall

Fields of Competence

Geology and hydrogeology with emphasis on groundwater contamination; development and implementation of environmental sampling plans; performance and evaluations of single-well hydraulic conductivity tests; use of surface geophysical techniques for the investigation of subsurface contaminant conditions; extensive stratigraphic logging and evaluation.

Experience Summary

Over one year experience in hydrogeology, involving such activities as: monitor well installation; monitor well development; hydraulic conductivity testing; environmental sampling of groundwater, surface water, and soil; development of major environmental sampling plans. Over one year experience in geophysics, involving use of: ground penetrating radar (GPR); electromagnetic conductivity (EM-31 and EM-34); magnetometry.

One year experience as a well site geologist logging stratigraphy of the Gulf Coast and southwest Texas regions.

Credentials

B.S., Geology—Southern Illinois University (1985)

Association of Groundwater Scientists and Engineers

Geological Society of America

Employment History

1987-Present	WESTON
1986	Illinois Department of Mines and Minerals
1985-1986	Anadrill-Schlumberger

Key Projects

Served as field geologist on a major U.S. Air Force environmental study. Activities included: development of sampling plan for 61 monitor wells; development of surface water sampling plan; monitor well development; performance and evaluation of hydraulic conductivity tests on 61 monitor wells.

Served as part of geophysical team at a U.S. Army Installation. Geophysical duties included: several ground penetrating radar (GPR) surveys; several electromagnetic (EM-34) surveys; reduction and evaluation of geophysical data.

Member of environmental sampling team investigating PCB contamination along a transcontinental pipeline. Activities included implementation of groundwater sampling plan and installation of dedicated pump systems for monitor wells.

Principal Investigator at a drum sampling site. Field activities included sampling, identification, and compilation of cyanide-contaminated drums.

Member of geophysical team at a U.S. Army depot. Activities included: setup of two extensive grid systems; magnetic gradiometer survey of grids; evaluation of geophysical data.

Principal Geologist on many industrial geophysics projects, utilizing ground penetrating radar (GPR), electromagnetics, and magnetics.

Professional Profile

Timothy S. Murphy

Fields of Competence

Data base design, implementation and management on mainframe computer systems and microcomputers, software design and application utilizing the following computer languages: FORTRAN, COBOL, PASCAL, C, BASIC, LISP, and dBASE III Plus, interaction and communication between mainframes and microcomputers, computer graphics.

Experience Summary

Experience in software design and application on various computer systems: Sperry/Univac 1100, VAX, Sperry PC/IT, IBM XT/AT, IBM/370, and Tektronix computer graphics software system. Experience in various computer software packages: Wordstar 2000, Crosstalk, Quickbasic, Dos, Freelance, Lotus 1-2-3, SAS, computer graphics.

Credentials

B.S., Computer Science—Drexel University (expected in 1988)

Employment History

1984-Present WESTON

Key Projects

Designed the data base and the software system for a Chemical Inventory Tracking System for a major precious metals firm and a glass works firm, which can also be used in conjunction with material safety data sheet (MSDS) software packages.

Designed and implemented an interactive, user-friendly data processing system which transformed the data received through WESTON's RAMDAS (Remote Air Monitoring Data Acquisition System) into the SAROAD output tables. This system has been used extensively for reporting the air monitoring results for over 20 monitoring sites.

Designed a data base system for a major refinery for weekly air toxic monitoring data. Developed software for legal reports. Summarized information stored in data bases.

Designed a data base system for microcomputer to store stack sampling surveys. Developed software for report generation of sampling results.

Modified the U.S. EPA's computer model (Industrial Source Complex Short-Term) ISCST for dry and wet deposition utilizing a micro meteorological parameterization consistent with California ARB requirements.

Designed a data base system for a major New York University to store the results of a comprehensive asbestos survey. Produced reports summarizing costs, analysis of samples, and summary by rooms.

Professional Profile

Julie L. Wilson, Ph.D.

Fields of Competence

Toxicology and risk assessment; industrial hygiene theory and applications, including safety and health evaluations and environmental audits; construction safety; health physics (ionizing and nonionizing radiation) and radiation safety in the clinical and industrial arena; asbestos hazard evaluation, control, and removal.

Experience Summary

Eight years experience in health and safety, including industrial hygiene, applied health physics, biosafety, and hazardous/infectous waste management. Training and program management in health and safety, industrial hygiene, and radiation safety. Project management of risk assessment/hazard evaluation of impact due to chemical process plants, landfills, mixed-waste facilities, and proposed solid waste and hazardous waste incineration facilities.

Credentials

B.S., Biology—Michigan Technological University (1977)

M.S., Health Physics—Purdue University (1979)

Ph.D., Toxicology—New York University (1986)

Society of Toxicology, Mid-Atlantic Chapter

Health Physics Society

American Industrial Hygiene Association

Employment History

1986-Present	WESTON
1985-1986	New York University Medical Center—Environmental Affairs
1981-1985	New York University Medical Center—Radiation Safety

Key Projects

Performed a comprehensive records audit of over 30 solid waste disposal companies and their receiving facilities prior to acquisition by a major waste management company.

Performed numerous real estate audits prior to property transfer which involved issues of asbestos, PCBs, and underground storage tanks on the sites.

Project manager for several risk assessments associated with RI/FS process for landfills.

Assisted in the development and implementation of the 40-hour hazardous waste training course for employees at the U.S. DOE's Hanford Nuclear Reservation, Washington.

Development and implementation of a program for compliance of health care institutions with Federal ethylene oxide standards. This program included worker training, development of a 24-hour monitoring program and emergency response.

Project manager for an infectious waste audit of a health care/research facility, including waste stream management, and pre- and post-generation handling. This project involved evaluation of sterilization and waste disposal hardware, including autoclaves and incinerators.

Project scientist on the air pollution risk assessment for a proposed resource recovery facility for Westinghouse in Bloomington, Indiana.

Project manager for several large-scale audits for asbestos-containing building material. Determined hazard and subsequent phasing of asbestos removal projects by use of the Navy algorithm.

Prepared site-specific, long-term asbestos management programs for controlling hazard until removal was possible.

Project manager for several large-scale asbestos removal projects, including removal specification determination.

Assisted in development of joint litigation against an asbestos manufacturer for the American Hospital Association.

Project manager for a medical gas monitoring program in 16 operating rooms, including implementation of a leak check and maintenance program for all anesthesiology equipment.

Project manager for evaluation of hazards (pathological and chemical) associated with the processing of human tissue samples in clinical analytical pathology and histology labs.

Right-to-know training of medical and research staff of hazards associated with their work. This included emergency response training for chemical spills.

Professional Profile

Publications

Dewey, W.C. and J.L. Wilson, "Transient Thermal Tolerance: Cell Killing and Polymerase Activities." *Radiation Research* 92:611-614, 1982.

Lippmann, M. and J.L. Wilson, "Effect of Lung Airway Branching Pattern and Gas Composition on Particle Deposition: I. Background and Literature Review." *Experimental Lung Research,* 14:311-320, 1988.

Wilson, J.L., D.M. Spektor, and M. Lippmann, "Effect of Lung Airway Branching Pattern and Gas Composition on Particle Deposition: II. Experimental Studies in Human and Canine Lungs." *Experimental Lung Research,* 14:321-328, 1988.

Lippmann, M., A.I. Nikiforov, J.L. Wilson, and D. Spektor, "Effects of Airway Branching Pattern on Particle Deposition in the Lung." *Annals of Occupational Hygiene,* in press.

Wilson, J.L., "Conducting Building Surveys for Asbestos: Architectual, Engineering, and Industrial Hygiene Perspectives." Presented at Current Issues in Asbestos Control, Northwest Center For Occupational Health and Safety, University of Washington, 1987.

Wilson, J.L., "Personal Protective Equipment For Women." Presented at Working Women: Occupational Health Issues of the 1980s, Northwest Center For Occupational Health and Safety, University of Washington, 1988.

P. STEVEN YOUNG, P.G.

Registration

Registered Professional Geologist in the State of North Carolina.

Fields of Competence

Groundwater hydrology; hydrogeochemistry; computer simulation of groundwater flow systems and contaminant transport; groundwater flow system analysis; groundwater contamination assessment; hydrogeologic investigations of hazardous waste sites.

Experience Summary

More than eight years of experience in hydrogeology, including investigation of contamination of existing hazardous waste sites and industrial facilities, location of municipal water supply wells, and evaluation of groundwater impacts from land application of wastewater disposal systems. Conducted computer modeling studies of groundwater flow systems and contaminant transport of hazardous waste sites. Conducted hydrogeologic investigations at hazardous waste and petroleum hydrocarbon contamination sites. Supervised three RI/FS projects at NPL sites in complex coastal plain geology. Developed a response, investigation, and remediation program for petroleum hydrocarbon contamination resulting from leaking underground storage tanks in the Atlantic coastal plain.

Credentials

B.S., Earth Science/Geology, The Pennsylvania State University (1979)

M.A.S., Water Resources, The University of Delaware (1985)

Association of Groundwater Scientists and Engineers

American Geophysical Union

Employment History

1986-Present	WESTON
1984-1986	Delaware Department of Natural Resources and Environmental Control
1983-1984	University of Delaware
1979-1983	Tatman and Lee Associates, Inc.

Key Projects

Associate Program Manager for implementation of remedial investigtions at several Department of Defense installations across the United States. Responsible for maintaining technical quality throughout the program.

Manager of the Hydrogeology Section in WESTON's Geosciences Department. Responsibilities include supervision of 14 professionals, staff development, quality control, and financial tracking.

Supervised investigation of waste material and soils at a U.S. Department of Energy facility in Ohio. Used a combination of geophysics and intensive sampling to maintain the most cost-effective program possible.

Used numerical computer modeling techniques to support development of expanded site investigation at an industrial site in California. Included development of an improved modeling approach to contaminant source representation.

Management of the remedial investigation activities at an NPL hazardous waste site in Delaware. Included design and installation of a monitor well network, coordination of geophysical surveys and soil, surface water, and groundwater sampling. Also involved participation in extensive distributed parameter numerical modeling of the site.

Supervision of the remedial investigation activities at an NPL site in central Delaware. Duties included direct responsibility for all staff personnel, coordination of field and laboratory activities, and budget review.

Development of a response investigation and remediation program for leaking underground storage tanks in Delaware. Provided supervision and technical support for staff-level scientists performing field investigations. Design of standard response procedures based on the nature of petroleum hydrocarbon contamination in the Atlantic Coastal Plain. Staff development and improvement of equipment and procedures were critical to program development.

Initiated and directed several hydrogeologic investigations at groundwater contamination sites throughout Delaware. Involved design of field investigation, sample collection, data analysis, and report preparation. Many of these reports have been published by the Delaware Department of Natural Resources and Environmental Control.

Applied computer simulation techniques to obtain solute transport predictions at a hazardous waste landfill in the Atlantic Coastal Plain. These predictions were prepared as input to a Feasibility Study.

Development of groundwater-based public water supplies for several public water supply systems. Included groundwater budget analysis, evaluation of existing and potential capacity, site selection for new well installation, and well construction supervision.

Publications

Apgar, M.A., P.S. Young, and R.L. McAllister, "Regional Variation in Determining Remedies for Cases of Groundwater Contamination in the Atlantic coastal Plain of Delaware." Abstract presented at the Association of Groundwater Scientists and Engineers, Baltimore, Maryland, 1985.

Apgar, M.A. and P.S. Young, "Superfund -- Repairs in Order." Presented at the Anatomy of Superfund Conference, Kansas City, Missouri, September 23, 1986.

Edward A. Need, P.G.

Certification

Certified Professional Geologist in the State of Indiana. Licensed Geologist in the State of North Carolina. Registered Professional Geologist in the State of South Carolina. Certified Professional Geologist, American Institute of Professional Geologists.

Fields of Competence

Department management and operations; hydrogeologic studies; site characterization of uncontrolled hazardous waste facilities; groundwater monitoring programs for RCRA permitting; environmental compliance audits; remedial investigation planning; project management; assessment of organic and inorganic groundwater contamination; evaluation of site suitability and permitting for solid and hazardous waste landfills; interpretation of geologic and hydrogeologic conditions relative to civil engineering and construction projects; environmental sampling of groundwater, surface water, soil and sediment.

Experience Summary

Eight years experience involving geological and hydrogeological aspects of environmental and engineering problems with emphasis on CERCLA investigations, RCRA permitting and glacial geology. Responsibilities have included geosciences department management; project management; investigation planning; cost and schedule development and control; field management of monitoring well installation and environmental sampling; monitoring well network design; site evaluation; and remedial action development. Projects have involved uncontrolled and/or abandoned waste sites; RCRA-regulated facilities with surface impoundments and landfills; and contamination of soil and groundwater from wastes of wood treating, metal finishing, coal gas manufacture, pigments manufacture, cement manufacture, petrochemical, agricultural supply, and foundry industries.

Credentials

B.A., Geology—Williams College (1978)

M.S., Geology—University of Wisconsin, Madison (1980)

M.S., Water Resources Management—University of Wisconsin, Madison (1981)

American Institute of Professional Geologists

Geological Society of America

Association of Groundwater Scientists and Engineers

American Quaternary Association

Employment History

1984-Present	WESTON
1981-1984	D'Appolonia Consulting Engineers, Inc./D'Appolonia Waste Management Services, Inc.
1980-1981	Wisconsin Geological and Natural History Survey

Key Projects

Geosciences Manager in regional office responsible for staff of 16 hydrogeologists, geologists, geophysicists and geochemists with respect to professional development, project assignments, technical performance and quality control for projects involving CERCLA site investigations, RCRA permitting and groundwater monitoring, and solid waste landfill permitting.

Project Manager and Project Hydrogeologist for RCRA hydrogeologic characterization and groundwater monitoring program at former pigment manufacturing facility in southeastern Kansas. Concluded monitoring not needed due to lack of on-site recharge, attenuative capacity of soil, and upward gradient from uppermost confined aquifer.

Project Hydrogeologist and Principal Investigator for CERCLA site investigation at abandoned municipal landfill adjacent to major river in north-central Illinois utilizing geophysics, landfill gas surveys, monitoring wells and environmental sampling.

Project Hydrogeologist and Principal Investigator for CERCLA site investigation at closed liquid waste treatment and incineration facility in southwestern Ohio involving complex glacial stratigraphy and multiple perched groundwater system, and on-site management of five-person field investigation team performing a wide range of environmental sampling activities.

Project Hydrogeologist and Project Manager for investigation of possible groundwater contamination of major alluvial

Professional Profile

aquifer from uncontrolled release of concentrated liquid fertilizer, including setup of a small on-site laboratory, and training of plant staff in laboratory operations and groundwater sampling; also involved negotiation assistance for development of an administrative consent order.

Project Hydrogeologist on multidisciplinary environmental audit team for inspection of a cellophane manufacturing facility which documented compliance with existing regulations but also a relatively high potential for future groundwater contamination due to inadequate spill-control structures in organic and inorganic chemical bulk storage areas.

Project Hydrogeologist for preparation of groundwater monitoring section of RCRA Part B permit application at uranium hexafluoride processing facility adjacent to a major river in southern Illinois, involving issues of monitoring seasonally perched water tables and the effects of temporary groundwater flow reversals (caused by flood stages in the river) on the performance of the groundwater monitoring system.

Project Geologist and Project Manager for investigation of heaving problems caused by interaction of clay soils and spilled caustic soda at major chemical manufacturing facility.

Project Hydrogeologist for investigation of surface and groundwater contamination resulting from disposal of cement kiln dust in an abandoned, water-filled quarry.

Project Hydrogeologist on project involving extensive contamination of shallow drinking water supply with volatile organic solvents, requiring interaction with public interest organizations and state agencies (health, regulatory, scientific and legal).

Project Hydrogeologist for comprehensive study of soil and groundwater contamination at site of former wood-treating operation, including investigation, feasibility and remedial action design.

Project Geologist on multifirm geotechnical engineering team, responsible for evaluating glacial and post-glacial soil material with respect to feasibility of CSO sewer construction and WWTP lake fill expansion.

Publications

Need, E.A., "Pleistocene Geology of Brown County, Wisconsin." Information Circular No. 48, Wisconsin Geological and Natural History Survey, 19 p., map, 1985.

Schneider, A.F. and E.A. Need, "Lake Milwaukee: An 'Early' Proglacial Lake in the Lake Michigan Basin." *Quaternary Evolution of the Great Lakes,* Karrow, P.F. and Calkin, P.E. eds., Geological Assoc. of Canada Special Paper 30, pp. 55-62, 1985.

Need, E.A. and M.J. Johnson, "Stratigraphy and History of Glacial Deposits along Wisconsin's Lake Superior Shoreline—Wisconsin Point to Back Bay." *Geoscience Wisconsin,* Vol. 9, pp. 21-51, 1984.

Need, E.A. and M.J. Costello, "Hydrogeologic Aspects of Slurry Wall Isolation Systems in Areas of High Downward Gradients." Proceedings of the Fourth National Symposium and Exposition on Aquifer Restoration and Groundwater Monitoring, National Water Well Association, Columbus, Ohio, 1984.

Schneider, A.F. and E.A. Need, "Lithologic and Stratigraphic Evidence for a Late Mid-Woodfordian Proglacial Lake in the Lake Michigan Basin." *Geological Society of America Abstracts,* Vol. 15, No. 6, p. 680, 1983.

Need, E.A., "The Quaternary Stratigraphy of the Lower Milwaukee and Menomonee River Valleys, Milwaukee, Wisconsin." *Lake Pleistocene History of Southeastern Wisconsin,* Mickelson, D.M. and L. Clayton, eds., *Geoscience Wisconsin,* Vol. 7, pp. 24-42, 1983.

Costello, M.J., D. Scherzer, E.A. Need, "Foundry Waste Audits Reuse for Construction." Sixth Annual Madison Conference of Applied Research and Practice on Municipal and Industrial Waste. Engineering and Applied Science, University of Wisconsin Extension, Madison, Wisconsin, 1983.

Need, E.A., M.D. Johnson, and D.M. Mickelson, "Till Stratigraphy and Glacial History Along the Western Shoreline of Wisconsin's Bayfield Peninsula." *Geological Society of America Abstracts,* Vol. 13, No. 6, p. 311, 1981.

Judith L. Stone

Fields of Competence

Project management and data management for analytical projects, including U.S. EPA Contract Laboratory Organics Program, U.S. EPA-CLP dioxin program, USATHAMA IRP program management, quality assurance/quality control.

Experience Summary

Twelve years of environmental analytical experience as a chemist, data manager, project manager and senior project scientist. Coordinate USATHAMA and U.S. Air Force installation restoration with field and laboratory personnel, monitor sample schedules, track samples and data, interface with client, maintain quality control charts. Project coordination for state and Federal CLP programs. Experience as project manager on U.S. EPA dioxin programs for Eastern Missouri cleanups. Preparation of Standard Operating Procedures, QC plans; development of sample tracking and chain-of-custody systems.

Additional experience includes monitoring laboratory QC procedures and supervising analysis of audit samples. Preparation of client reports.

Credentials

B.S., Chemistry—Dickinson College (1973)

American Chemical Society

Association of Official Analytical Chemists

Employment History

1986-Present	WESTON
1974-1986	Envirodyne Engineers, Inc.
1973-1974	Chilton Publishing
1969-1973	Dickinson College

Key Projects

Project Manager of two-year analytical contract with New York State Department of Environmental Conservation. Coordinator between laboratory and numerous client personnel in scheduling sample receipt. Monitor sample status and reporting.

Laboratory coordinator and central communications person for Air Force tasks. Coordinate sampling and analysis schedule with task managers and laboratory personnel. Monitor analytical progress and data reporting.

Program Manager for U.S. EPA-CLP dioxin IFB and SAS programs. Scheduled sample receipt and analysis. Reviewed data, prepared reports, submitted billing information to accounting and supervised document control. Prepared Standard Operating Procedures for the dioxin and IFB projects.

Project Manager for two-year contract with U.S. Army Corps of Engineers district for sampling and analysis in the Great Lakes. Scheduled tasks with client, prepared invoices, monitored labor costs and prepared data reports.

Data Manager and Project Coordinator for U.S. EPA Effluent Guidelines Division contracts for organics, plastics, rubber and timber industries. Developed laboratory record-keeping system including chain-of-custody, work request, extraction records and sample log forms. Revised company sampling manual for Consolidated Permits Program.

Laboratory Project Manager for USATHAMA multi-installation contract. Supervised preparation and shipment of sample bottles, receipt of samples. Monitored scheduling of sample analysis and tracked sample flow. Reviewed inorganic and organic data. Supervised laboratory certification, established and maintained quality control charts to monitor compliance with client's QA program. Wrote analytical sections of proposals, reports, QA and technical plans.

Professional Profile

Michael G. Stapleton

Fields of Competence

Industrial waste treatability studies; chemical treatment of hazardous and industrial wastes; groundwater monitoring; soil sampling; and wet chemical environmental sample analyses.

Experience Summary

Bench-scale modeling of industrial waste treatment methods; RCRA testing for EP toxicity, groundwater quality monitoring; and wet chemical analyses of environmental samples.

Instrumentation experience: atomic absorption, infrared, UV-VIS spectrophotometers.

Credentials

B.S., Earth and Environmental Sciences—Wilkes College (1981)

Employment History

1984-Present	WESTON
1981-1984	Chem-Clear, Inc.

Key Projects

Assistant Project Scientist for execution of static bioassays for a pharmaceutical firm as part of NPDES compliance testing.

Participant in large-scale water quality and biological sampling project along 40 miles of a North Carolina river for a major paper company.

Industrial source emission testing projects involving glass manufacturing, asphalt production, steel manufacturing, and chlorinated organic producing facilities.

Attendance at a training session for initial site investigation of hazardous waste dump sites.

Participation in two on-site information gathering sessions, looking into past and present chemical use and disposal at present air force facilities.

Investigation and development of testing methods of anaerobic digestion inhibition for a major chemical firm.

Participant in bathymetric study for PSE&G.

Professional Profile

PETER ERDNWEIN

Fields of Competence

Multi-pathway risk assessment; site reconaissance; saftey assessment toxicology; clinical toxicology; water chemistry; evaluation of field data; personnel management; preparation of toxicology and fate profiles.

Experience Summary

Over two years experience as a laboratory technician in health-related industry. Wide experience in risk asessment process including contaminant characterization, exposure assessment, and risk modeling.

Credentials

B.S., Toxicology -- Philadelphia College of Pharmacy & Science (1988)

Employment History

1988 - Present	WESTON
1987 - 1988	DHS Insurance Corp.
1986 - 1987	Smith Kline Beckman
1984 - 1985	Ciba Geigy Corp.
1982 - 1983	American Health Found.

Key Projects

Responsible for fate and exposure characterization in a risk assessment for Uranium Mill Tailings Remedial Action Project - Green River, Utah.

Responsible for site reconaissance, screening of contaminants of concern, and soil exposure pathways for a risk assessment of a biomedical waste incinerator for Smith Kline Bioscience, West Norriton, Pennsylvania.

Responsible for characterization of ingredient chemicals for a chemical compatibility assessment for Okidata, Cherry Hill, New Jersey..

Prepared toxicolgy and fate profiles for Atlantic Richfield Chemical Company, Newtown Square, Pennsylvania.

Responsible for characterization of potential human and industrail groundwater use for an exposure assessment for Pacific Valves, Long Beach, California.

Robert H. Gilbertsen

Registration

Registered Engineer-in-Training in the State of Indiana.

Fields of Competence

Remedial investigation and feasibility study; environmental model development and application; construction inspection; environmental impact assessment; environmental audit; compliance monitoring.

Experience Summary

Experience with various aspects of hazardous waste feasibility studies, including alternative remediation and alternative generation and comparison; predesign report preparation.

Experience in environmental audits includes visual, chemical, and geophysical survey for real estate transaction.

Experience in regulatory compliance includes preparation of hazardous waste disposal unit's sampling and statistical analysis plan.

Experience in environmental impact assessment includes preparation of portions of a report detailing the environmental impact of a high-energy physics research facility.

Other experience includes conceptual and detailed civil engineering design, construction inspection, and environmental permit preparation.

Credentials

B.S., Civil Engineering—Purdue University (1985)

M.S., Environmental Engineering—University of North Carolina (1987)

American Society of Civil Engineers, Secretary of Illinois Section, Environmental Engineering and Water Resources Division

American Water Works Association

National Water Well Association

Tau Beta Pi

Chi Epsilon

Employment History

1988-Present	WESTON
1987-1988	Harza Environmental Services
1985-1987	University of North Carolina
1985 (Summer)	M.D. Wessler and Associates

Key Projects

Developed pre-design report for the Pristine, Inc. Superfund site in Reading, Ohio. Scope of technical responsibilities included providing detailed engineering recommendations for additional data gathering and evaluation as a followup to the feasibility study's conclusions. This assessment included determination of pre-design data requirements for a groundwater extraction and treatment system, contaminated soils excavation and staging, and in situ vitrification treatment.

Prepared concept design plans and engineer's cost estimates for remediation of a flooded, PCB-contaminated underground vault tank storage system at a former industrial manufacturing facility. Design work encompassed a determination of existing site conditions, wastewater characterization, development of treatment system specifications, and remedial operating plans.

Assessed remedial technologies for eight contaminated sites at Selfridge Air National Guard Base. Responsibilities included identification and screening of technologies, assembly of screened technologies into operable units, assembly of operable units into alternatives, and preparation of cost estimates. Also performed hazard ranking for the sites at the Selfridge Base. The ranking required use of the USAF's Defense Priority Model to score the sites.

Developed conceptual design and cost estimate for cleanup of contaminated soil and groundwater beneath a private electronics manufacturing facility. The conceptual design involved assembly and analysis of alternative cleanup plans for the site.

Analyzed cleanup alternatives for the Velsicol Chemical Corporation Superfund site. Activities included analysis of protection of health and the environment; compliance with applicable or relevant and appropriate requirements; long-term and short-term effectiveness; implementability; reduction of mobility, toxicity, and volume; state acceptance; and cost.

Professional Profile

Developed conceptual design and engineer's cost estimate for cleanup of contaminated soil at a former private manufacturing facility. Activities encompassed selection of the region of remediation, development and comparison of remedial alternatives, and preparation of cost estimates.

Sailesh Banaji

Fields of Competence

Currently working as a Civil/Environmental Engineer with experience in wastewater water supply and hazardous waste engineering. Have experience working on sites sponsored by U.S. EPA to perform Remedial Investigations and Feasibility Studies of Superfund projects. Also worked for two years as a wastewater plant operator at an advanced wastewater treatment facility.

Experience Summary

Experience in hazardous waste management, including site investigations, sampling, and field instrumentation. Implementing health and safety procedures at hazardous waste sites. Experience in remedial investigations/feasibility studies (RI/FS) for state and Federal projects under CERCLA. Experience includes detailed quality assurance project plans (QAPP), work plans, health and safety reports, ARAR and RI/FS reports, data analysis, and selection and design of remedial technologies. Also, experience in municipal wastewater plant operation and analysis of wastewater to meet NPDES standard.

Credentials

Bachelor of Engineering (Civil)
Bangalore University - 1983

M.S. Candidate - Civil Engineering
South Dakota State University
Expected date of graduation - 1988

American Society of Civil Engineers
American Water Works Association
National Society of Professional Engineers

Employment History

1988 - Present	WESTON
1987-88	C.C.Johnson & Malhotra, P.C.
1985-87	Brookings Municipal Utilities South Dakota
1984-85	South Dakota State University

Key Projects

Conducted field activities at several Region V REM II and REM V (Superfund) hazardous waste sites. Activities included mobilization, site assessment, and field monitoring/sampling of all types of media.

Assisted in the Remedial Investigation/Feasibility Study of a 35-acre REM V site in Wisconsin. Responsibilities included ISER, QAPP, health and safety plan and, work plan preparation. Also assisted in site mobilization for Remedial Investigation and field sampling.

Member of RI/FS team for a REM II Superfund landfill site in Ohio. Responsibilities included screening of remedial actions, and preparation of the Request for ARARS document and the Feasibility Study for a complex 28 acre municipal, industrial landfill.

Worked as a wastewater plant operator at a 3 MGD Advanced Wastewater Treatment Facility. Was responsible for day-to-day operation of the plant on eight hour shifts of various treatment units. This included monitoring the wastewater and sampling to meet EPA discharge standards, which involved laboratory analysis.

Additional responsibilities assigned were preparing an Annual Technical Report for the City of Brookings Utilities Board by collecting data and coordinating between various city utility departments.

Raymond H. Alexander

Fields of Competence

Technical editing and writing; production scheduling; on-line and manual data base searches; software utilization; chemical information analysis; chemical synthesis and analysis.

Experience Summary

More than four years experience as technical editor/writer and information analyst. Abstracted and indexed chemical information for preparation of weekly and monthly publications and for inclusion in chemical data base. Abstracted and indexed environmental journal articles and reports for U.S. Geological Survey publication and for inclusion in U.S. Geological Survey data base. More than 12 years experience in chemical research and development including synthesis and analysis.

Credentials

B.S., Chemistry—Kensington University (1974)

Familiar with Wiswesser Line Notation

Completed Several American Chemical Society "Short Courses"

American Chemical Society, Organic Chemistry and Chemical Information Divisions

American Institute of Chemists

Employment History

1987—Present	WESTON
1986-1987	Peters Technology Transfer
1983-1986	Institute for Scientific Information
1981-1982	Petrarch Systems, Inc.
1970-1980	Pacific Research Co.
1967-1969	U.S. Marine Corps

Key Projects

Serving as designated lead editor for all U.S. Air Force Installation Restoration Program reports, work plans, and technical documents.

Devised and implemented computer tracking system using commercial software that yields significant clerical time savings, prevents format errors, and increases productivity.

Developed and implemented indexing criteria for "Biological Activities Index."

Performed on-line testing of new data bases.

Managed numerous chemical research projects to develop and implement multistep, cost-effective syntheses of chemical compounds of interest.

Managed chemical research projects to synthesize, analyze, and test monomers and polymers as water treatment compounds.

Designed and installed project-specific chemical laboratories.

Professional Profile

APPENDIX E

NATIONAL AMBIENT AIR QUALITY STANDARDS

TABLE E-1
NATIONAL AMBIENT AIR QUALITY STANDARDS
IRP STAGE 2
SELFRIDGE ANGB, MICHIGAN

	Primary	Secondary
Total Particulate Matter(1)		
Annual geometric mean	75 ug/m^3	
Maximum 24-hour concentration(2)	260 ug/m^3	150 ug/m^3
Particulate Matter <10 Microns(1)		
Annual geometric mean	50 ug/m^3	150 ug/m^3
Maximum 24-hour concentration(2)	150 ug/m^3	150 ug/m^3
Sulfur Dioxide		
Annual arithmetic mean	80 ug/m^3	
Maximum 24-hour concentration(2)	365 ug/m^3	
Maximum 3-hour concentration(2)		1300 ug/m^3
Carbon Monoxide		
Maximum 8-hour concentration(2)	9 ppm	9 ppm
Maximum 1-hour concentration(2)	35 ppm	35 ppm
Ozone		
Maximum daily 1-hour concentration	.12 ppm	.12 ppm
Nitrogen Dioxide		
Annual arithmetic mean	100 ug/m^3	100 ug/m^3
Lead		
Maximum calendar quarter average	1.5 ug/m^3	1.5 ug/m^3

(1) The particulate matter <10 standard replaces the total particulate matter standard as of July 1987.
(2) Not to be exceeded more than once a year per site.
Source: U.S. Environmental Protection Agency.

APPENDIX F

QUALITY ASSURANCE PROJECT PLAN

4191B

INSTALLATION RESTORATION PROGRAM STAGE 2

FOR

SELFRIDGE AIR NATIONAL GUARD BASE, MOUNT CLEMENS, MICHIGAN

Roy F. Weston, Inc.
West Chester, Pennsylvania 19380

FEBRUARY 1988

FINAL QUALITY ASSURANCE PROJECT PLAN

PREPARED FOR:

AIR NATIONAL GUARD SUPPORT CENTER
OFFICE OF THE AIR SURGEON GENERAL (ANGSC/SGB)
ANDREWS AIR FORCE BASE, MARYLAND 20331-6008

UNITED STATES AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
TECHNICAL SERVICES DIVISION (USAFOEHL/TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

INSTALLATION RESTORATION PROGRAM

STAGE 2

FINAL QUALITY ASSURANCE PROJECT PLAN

For

Selfridge Air National Guard Base,
Mount Clemens, Michigan

Air National Guard Support Center
Office of the Air Surgeon General (ANGSC/SGB)
Andrews Air Force Base, Maryland 20331-6008

February 1988

Prepared By:

Roy F. Weston, Inc.
Weston Way
West Chester, Pennsylvania 19380

USAF Contract No. F33615-87-D-4018, Delivery Order No. 0002
Contractor Contract No. F33615-87-D-4018, Delivery Order No.0002

USAFOEHL Technical Program Manager
Mr. Augustus K. Lo

USAF Occupational & Environmental Health Laboratory (USAFOEHL)
Technical Services Division (TS)
Brooks Air Force Base, Texas 78235-5501

1911B

WESTON

QUALITY ASSURANCE PROJECT PLAN APPROVAL

This Quality Assurance Project Plan (QAPP) was developed to assure that all environmental data generated for the U.S. Air Force Installation Restoration Program are scientifically valid, defensible, comparable, and of known and acceptable precision and accuracy. The below signatures of key project personnel indicate concurrence with the procedures specified in this plan and a commitment to disseminate this plan and the philosophy of quality to all project personnel.

	Signature	Date
Katherine A. Sheedy, Program Manager	Kath A Sheedy	2/10/88
Edward A. Need, Task Manager	Edward A. Need	2-10-88
Judy Stone, Laboratory Project Manager	Judy Stone	2-12-88
Robert C. Brod, Project QA Officer	Robert C Brod	2/11/88
Dianne S. Therry, QA Coordinator - Analytical Laboratory	Dianne S. Therry	12 Feb 88
Carter P. Nulton, Ph.D., Manager - Analytical Laboratory	Carter P Nulton	12 Feb 88

This plan is approved for use in the Selfridge Air National Guard Base Remedial Investigation.

Augustus K. Lo

Mr. Augustus K. Lo
Technical Program Manager

17 Feb 88
Date

1911B

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES
(continued)

SECTION 1

QUALITY ASSURANCE/QUALITY CONTROL

1913B

SECTION 1

QUALITY ASSURANCE/QUALITY CONTROL

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is one of three planning documents that describes activities to be undertaken as part of the Installation Restoration Program (IRP) Stage 2 investigation at Selfridge Air National Guard Base (Selfridge ANGB). The other documents are:

- Work Plan for the Installation Restoration Program - Stage 2 -- presents the available information concerning the site's history and potential hazards, candidate site remediation technologies, and activities proposed to evaluate the site and to select remedial action alternatives.

- Health and Safety Plan (HSP) -- contains site-specific information concerning types of facilities, waste types and characteristics, types of hazards, levels of protection, surveillance equipment to be used, and emergency precautions. A Site Security Plan is incorporated with a Site Safety Plan to delineate efforts required to secure operations at the site.

The purpose of the QAPP is to describe:

- Quality assurance objectives.
- Sampling and laboratory procedures.
- Sample custody procedures.
- Protocols for field activities.
- Calibration procedures, references, and frequencies.
- Internal Quality Control (QC) checks.
- QA performance and system audits.
- Preventive maintenance procedures and schedules.
- Data assessment procedures.
- Corrective actions.
- QA reports to management.

1.2 PROJECT DESCRIPTION

1.2.1 General

In 1976, the Department of Defense (DOD) devised a comprehensive Installation Restoration Program (IRP). The purpose of the IRP is to assess and control migration of environmental contamination that may have resulted from past operations and disposal practices on DOD facilities. In response to the Resource Conservation and Recovery Act of 1976 (RCRA) and in anticipation of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or "Superfund"), DOD issued a Defense Environmental Quality Program Policy Memorandum (DEQPPM) dated June 1980 (DEQPPM 80-6) that requires identification of past hazardous waste disposal sites on DOD agency installations. The U.S. Air Force (USAF) implemented DEQPPM 80-6 by message in December 1980. The program was revised by DEQPPM 81-5 (11 December 1981) which reissued and amplified all previous directives and memoranda on the IRP. The Air Force implemented DEQPPM 81-5 by message on 21 January 1982. Based on experience at Air Force bases nationwide, the U.S. Air Force has adopted an approach that streamlines and integrates elements of the program by allowing remedial investigations to progress simultaneously with feasibility studies of potential remedial alternatives. This phase of the Installation Restoration Program is now referred to as RI/FS Stage 2.

The IRP investigations for Selfridge ANGB that have been completed to date include the Phase I Problem Identification/ Records Search (Environmental Control Technology Corporation, 1983), the Phase II Presurvey (WESTON, 1984), and the Phase II Stage 1 Confirmation Study Investigation (WESTON, 1986). Based upon the conclusions of the Phase I Records Search and the Phase II Presurvey Report, seven sites at Selfridge ANGB were recommended for Phase II Stage 1 Confirmation Study investigations.

On the basis of the findings of the Phase II Stage 1 investigations, the seven sites at Selfridge ANGB were recommended for further investigation (i.e., identified as Category II sites). These sites are the Southwest Sanitary Landfill (SWLF), Fire Training Area 2 (FTA-2), Fire Training Area 1 (FTA-1), the West Ramp (WRMP), the Tucker Creek Landfill (TCLF), the Northwest Landfill (NWLF), and the East Ramp (ERMP). In addition, Selfridge ANGB personnel requested that the Base Coal Storage Pile (BCSP), adjacent to the Civil Engineering Complex, be added to the sites to be investigated. Therefore, a total of eight sites will be studied during the IRP Stage 2 investigations. Those sites and their abbreviated designations are listed in Table 1-1. Their locations are shown in Figure 1-1.

Table 1-1

List of IRP RI/FS Stage 2 Sites,
Selfridge ANGB, Michigan

Site No.	WESTON Site Designation	Site Description
1	SWLF	Southwest Sanitary Landfill; received residential and industrial waste including solvents and paints.
2	FTA-2	Fire Training Area 2; active fire training area.
3	FTA-1	Fire Training Area 1; former fire training area.
4	WRMP	West Ramp; aircraft maintenance and fueling area, site of two fuel spills.
5	TCLF	Tucker Creek Landfill; received debris and industrial waste including demolition solvents.
6	NWLF	Northwest Landfill; received residential and industrial waste including solvents, paint, and oils.
7	ERMP	East Ramp; aircraft maintenance and fueling area, site of a fuel spill.
8	BCSP	Base Coal Storage Pile.

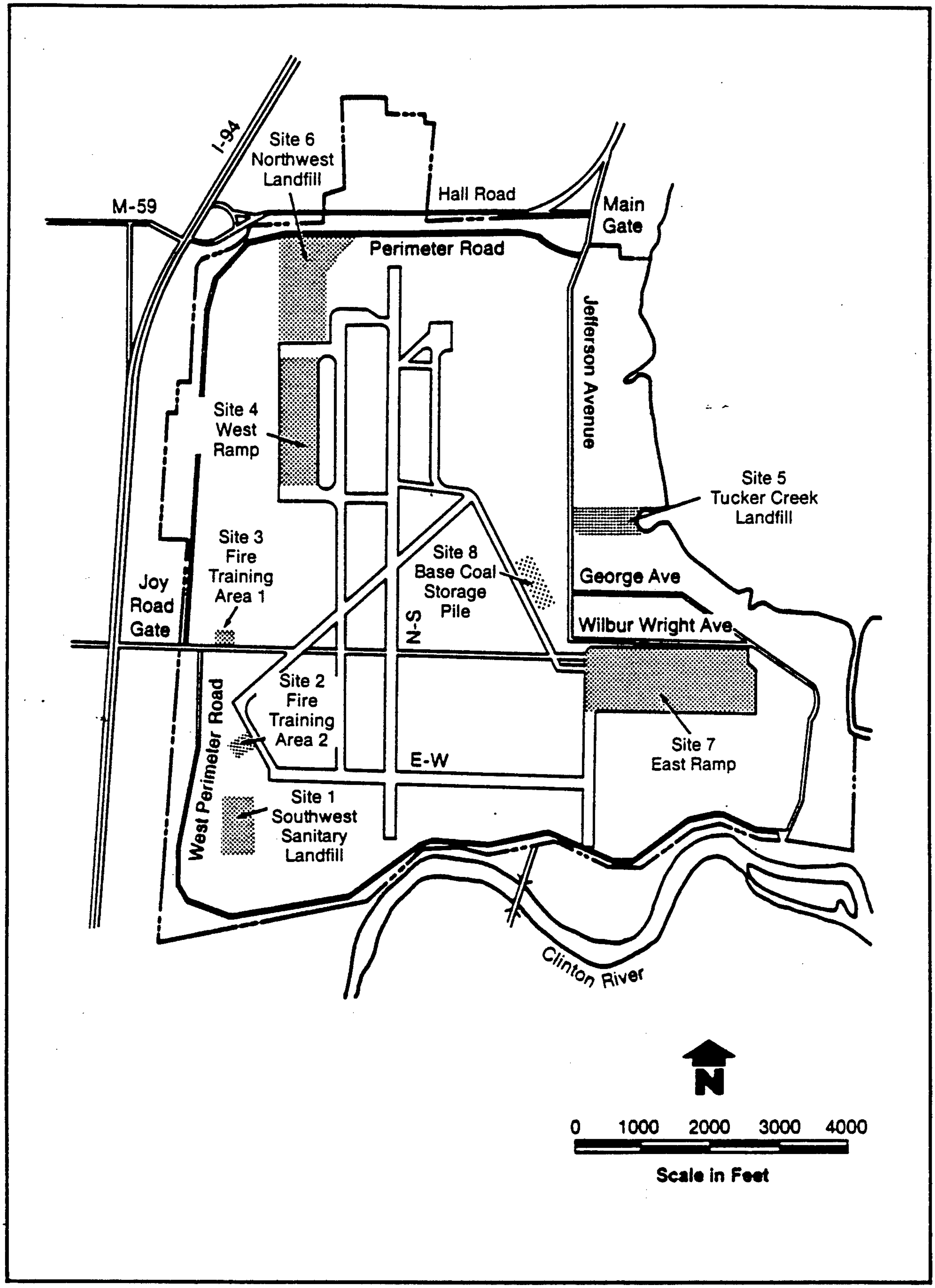


FIGURE 1-1 IRP RI/FS STAGE 2 SITE LOCATIONS, SELFRIDGE ANGB, MICHIGAN

1.2.2 Background

Selfridge ANGB is located in Macomb County, Michigan, on the western shore of Lake St. Clair, 0.5 miles to the east of Mount Clemens, Michigan. The southern border of the base adjoins North River Road and the Clinton River, which flows east and discharges to Anchor Bay of Lake St. Clair. Hall Road borders the base on the north. The base has been active since 1922, operating under the Army, the Air Force, and the Air National Guard Command. The primary mission of the base is to train Air National Guard personnel.

Selfridge ANGB occupies approximately 3,184 acres. The topography of the base is due to glacial lake bed deposits from the ancestral Lake St. Clair during the last of the Pleistocene glaciation. The site topography slopes gently eastward toward the present Lake St. Clair. The only relief on the base is due to natural and man-made surface drainage and the presence of two glacial lake paleo-shorelines representing earlier higher lake levels. Sugarbush Road, which ends at the northern end of the base, follows the route of the younger of the paleo-shorelines, and Gratiot Avenue, located west of the base, follows the route of the second paleo-shoreline. Drainage from the area is to Lake St. Clair via the Clinton River which discharges to the lake immediately south of the base, as well as to numerous other smaller rivers, streams, and drains which also flow directly to Lake St. Clair.

Present base topography results from the combination of the location of the lake bed and cutting and filling operations conducted over the years. Elevations across the base range from 585 feet above mean sea level (MSL) at the extreme northwestern corner to 575 feet above MSL at the present lake shoreline. This gives an approximate maximum relief of 10 feet, with the exception of a few small construction embankments.

The glacial deposits on the base are primarily clayey glacial drift that contain variable and minor amounts of silty sand and gravel with occasional lenses of silty and sandy sediments. These coarser sediments suggest some of the clays are till deposits associated with ground moraine to the west. Some surficial sands have been found in the first 24 feet of deposits in the southwestern corner of the base. These are probably alluvial deposits of the Clinton River. Fill material taken from the sand deposits has been placed to raise much of the base to its current ground level elevation.

The glacial drift is unconformably underlain by the Late Devonian System Antrim Shale at depths from less than 100 to approximately 150 feet below land surface (BLS). The Antrim Shale is a cinnamon brown to black and dark gray bituminous shale which is thin bedded to fissile. The Antrim Shale dips northeastward to form part of a bowl-shaped depression known as the Michigan Basin. Selfridge ANGB lies on the southeastern flank of that bedrock structure.

The following sections present a summary of the information available from earlier investigations and describe site histories and environmental settings on a site-by-site basis. The sites are discussed in order of their priority.

1.2.2.1 Site 1 - Southwest Landfill (SWLF)

Site Description:

The Southwest Landfill was used in the past to dispose residential and industrial waste. The site is located in the southwestern corner of the base. Currently, the site is used for disposal of demolition and landscape debris plus ash from the base coal-fired power plant.

Size:

40 acres.

Period of Use:

1970 - present.

Past Practices:

The Southwest Landfill operated from 1970 to 1978 under Michigan Public Act 87, as amended, for the disposal of approximately 5,900 tons per year of residential and industrial waste. Typical wastes brought to the site were demolition materials, residential waste, solvents, trichloroethylene, carbon tetrachloride, methyl ethyl ketone, paint strippers and thinners, and waste oils. Clayey sand was used for daily cover. The site is now used to dispose demolition and landscape debris and ash from the base coal-fired power plant.

Summary of Phase II Stage 1 Investigation:

The Phase II Stage 1 investigation at this site consisted of installing four groundwater monitor wells (W22 through W25) screened into the upper 20 feet of the unconsolidated formation. Three surface water samples were retained; two from ponded

areas in the middle of the landfill and one from a ravine located to the northwest of the site. The groundwater and surface water samples were analyzed for volatile organic compounds (VOCs), total organic carbon (TOC), oil and grease (O&G), chemical oxygen demand (COD), total phenolics, petroleum hydrocarbons, and heavy metals. Oil and grease was detected at a maximum concentration of 1.38 mg/L, phenolics at 435 ug/L, TOC at 13.5 mg/L, COD at 3,150 mg/L, lead at 20 mg/L, and copper at 1,100 ug/L.

The Phase II Stage 1 investigation found alluvial deposits of gray to brown moderately to poorly sorted clays, silts, sands, and gravel from the Clinton River meander belt. Saturated soils were encountered within 5 to 10 feet below land surface. Groundwater occurs under water table and/or under semi-confined conditions at the Southwest Landfill. The hydraulic gradient in the southwestern corner of the base is to the northeast at approximately 0.0048 feet per foot. This suggests the Clinton River may be a source of recharge to the shallow aquifer beneath the southern portion of the base. The steeper hydraulic gradient north of the Southwest Landfill indicates that the permeability of the shallow unconsolidated formation decreases northward from the Clinton River meander belt.

1.2.2.2 Site 2 - Fire Training Area 2 (FTA-2)

Site Description:

Fire Training Area 2 is located in the southwestern quadrant of the base, north of the Southwest Landfill, and west of the C Taxiway. The site has been used since 1968 to conduct fire training exercises.

Size:

4 acres.

Period of Use:

1968 - present.

Past Practices:

The site was excavated to 1 to 1.5 feet BLS and was filled with broken concrete and demolition materials. No liner was installed prior to backfilling the pit excavation. Eight to twelve training fires are conducted each year. Approximately 350 to 500 gallons of JP-4 are pumped into the pit, are ignited, and then are extinguished, leaving approximately 25 percent of the fuel as residue.

Summary of Phase II Stage 1 Investigation:

The Phase II Stage 1 investigation at this site consisted of installing and sampling three monitor wells (W19, W20, and W21) and collecting surface water from two ponded water locations. The samples were analyzed for VOCs, TOC, phenols, and petroleum hydrocarbons. Petroleum hydrocarbons were detected at a maximum concentration of 69.0 mg/L, phenolics at 147 mg/L, TOC at 165.0 mg/L, and trichloroethylene at 3.2 ug/L.

The Phase II Stage 1 investigation found thin silty sand lenses interbedded with lacustrine silts and clays in the subsurface under Fire Training Area 2. The saturated materials (the thin silty sand lenses) occur at a depth of 12 to 15 feet BLS. Static water levels are generally within 2.5 to 7.5 feet of the land surface indicating confined conditions. The hydraulic gradient in the vicinity of this site is consistent with that of the Southwest Sanitary Landfill at approximately 0.006 feet per foot toward the northwest. Northeast of FTA-2, the hydraulic gradient flattens and changes orientation to the east.

1.2.2.3 Site 3 - Fire Training Area 1 (FTA-1)

Site Description:

Fire Training Area 1 (FTA-1) is located to the north of FTA-2, near Building 567, in an unlined pit backfilled with gravel. The pit was used until 1967 for fire training exercises. The area is currently surrounded by a security fence and is used as an unpaved parking area.

Size:

One-quarter acre.

Period of Use:

1952 - 1967.

Past Practices:

From 1952 until 1967, the fire department used ignited waste flammables (e.g., JP-4, solvents, strippers, and thinners) in the pit for fire training exercises. The waste flammables were stored in drums on-site between fire training exercises. It is assumed that the FTA-1 configuration and construction were similar to that of Fire Training Area 2, although no drawings exist of the facility. It is also assumed that the burn efficiency of the training exercises was similar (approximately 75 percent of flammables consumed per burn).

Summary of Phase II Stage 1 Investigation:

The Phase II Stage 1 field investigation consisted of installing three groundwater monitor wells into the unconsolidated formation. The wells were sampled and were analyzed for VOCs, TOC, petroleum hydrocarbons, and phenolics. Petroleum hydrocarbons were detected at a maximum concentration of 1.0 mg/L, phenolics at 7 ug/L, and TOC at 5.7 mg/L.

The Phase II Stage 1 subsurface drilling found lacustrine silts and clays. Groundwater occurs within them under confined conditions at depths greater than 10 to 12 feet BLS. The hydraulic gradient is approximately 0.004 feet per foot to the southeast in the vicinity of this site. The hydraulic gradient flattens north and southeast of this site. The lack of monitor wells in this area makes interpretation of this variation impossible.

1.2.2.4 Site 4 - West Ramp (WRMP)

Site Description:

The West Ramp is located in the northwestern portion of the base. The West Ramp is bounded on the north by the Northwest Landfill, on the east by the airfield, on the south by an undeveloped wooded area, and on the west by aircraft hangars and support buildings. The ramp is utilized for aircraft parking, maintenance, and fueling.

Size:

85 acres.

Period of Use:

1922 - present.

Past Practices:

The West Ramp is used for aircraft parking, maintenance, and fueling. Two fuel spills, involving a total of over 3,000 gallons of JP-4, have occurred in the southwestern portion of the aircraft parking area, near a buried fuel line pump station. Both of the spills were related to malfunctions of pumping equipment. Remedial cleanup activities were performed by base personnel, but the bulk of the fuel drained into a landscaped depression between the aircraft hangars and the parking area. Base personnel have noted fuel odor in this area during extensive wet periods.

Summary of Phase II Stage 1 Investigation:

Field investigation during the Phase II Stage 1 study included installing five groundwater monitor wells into the unconsolidated formation. The wells were sampled and were analyzed for VOCs, TOC, and petroleum hydrocarbons. Petroleum hydrocarbons were detected at maximum concentrations of 2.4 mg/L, VOCs at 7.2 ug/L, and TOC at 12.0 mg/L. Three soil samples were retained from each well installation during drilling and were analyzed for VOCs and O&G. The samples were retained from the 2.5-, 7.5-, and 10.5- foot depths. Oil and grease was detected at maximum concentrations of 17,900 mg/kg, although averaging in most soil samples between 65 and 223 mg/kg. Benzene, toluene, ethylbenzene, trichloroethylene, trichlorofluoromethane, methylene chloride, and chloroform were the most commonly reported VOCs in the soil samples from the West Ramp. Concentrations ranged from 5 to 1,500 ug/g. Trichloroethylene was the most common, occurring in every sample with concentrations up to 1,500 ug/g.

Water-saturated materials were encountered within the lacustrine silts and clays at a depth of 6 to 14 feet BLS. An area of silty fine sand encountered at a depth of 20 feet BLS provides the major source of water in the monitor wells. The depth to static water level varied between 0.5 to 3.0 feet BLS. The hydraulic gradient is very flat (approximately 0.0008 feet per foot) and oriented toward the south-southwest in the West Ramp area.

1.2.2.5 Site 5 - Tucker Creek Landfill (TCLF)

Site Description:

A natural depression on the eastern side of Selfridge ANGB was used for disposal of waste materials. The site is bounded on the north by Building 970, on the south by the base school, on the east by Lake St. Clair, and on the west by Jefferson Avenue. The Phase II Stage 1 investigation found some indications that the landfill activities may have extended north beyond those boundaries.

Size:

9 acres minimum.

Period of Use:

1930 - 1955.

Past Practices:

During its active period, the area was used for disposal of demolition materials, residential refuse, and industrial waste materials such as carbon tetrachloride and trichloroethylene. Refuse was commonly burned in the landfill during this period.

Summary of Phase II Stage 1 Investigation:

During the Phase II Stage 1 investigation, three monitor wells were installed in the unconsolidated formation. Groundwater samples from the wells were analyzed for VOCs, TOC, phenols, COD, heavy metals, and O&G. Copper was detected at a maximum concentration of 1,900 ug/L, lead at 44 ug/L, cadmium at 14 ug/L, O&G at 1.17 mg/L, TOC at 16.4 mg/L, phenolics at 10 ug/L, and COD at 688 mg/L.

Groundwater was found in the lacustrine silts and clays at a depth of 12 to 14 feet BLS. The static water level occurs within 1 to 4 feet of the land surface. The hydraulic gradient is eastward at approximately 0.0044 feet per foot across the site. The relative steepness of the gradient near this site suggests either the presence of a source of recharge west of the land-fill and/or a belt of material with low permeability near the shorelines of Lake St. Clair.

1.2.2.6 Site 6 - Northwest Landfill (NWLF)

The Northwest Landfill is located in the northwestern corner of the base. Originally, the site was a natural sand pit that was excavated for use in runway construction. It was then used for waste disposal. The site is bounded by the Perimeter Road to the north, the airfield to the east, the West Ramp to the south, and the radar station to the west.

Size:

26 acres.

Period of Use:

1955 - 1975.

Past Practices:

Demolition materials were placed on the bottom of the pit, followed by residential and industrial waste. Clay and clayey sands were used for daily cover. Industrial waste products such as solvents, paint thinners, paint strippers, waste oils, and

fuels were landfilled at the site. Fuel management reports disposal of 50 to 150 gallons of tetraethyl lead at this site during its operation.

Summary of Phase II Stage 1 Investigation:

During the Phase II Stage 1 investigation, three groundwater monitor wells were installed into the unconsolidated formation. The wells were sampled and were analyzed for VOCs, TOC, phenols, COD, heavy metals, and O&G. Copper was detected at a maximum concentration of 1,600 ug/L, lead at 24 ug/L, total phenolics at 15 ug/L, TOC at 52 mg/L, COD at 565.0 mg/L, and O&G at 1.55 mg/L. A trace amount of trichlorofluoromethane (2.2 ug/L) was found in one groundwater sample.

The Phase II Stage 1 investigation detected a water table aquifer at depths of 2 to 5 feet in surficial sands. Those sands are associated with the historic shoreline of Lake St. Clair that paralleled Sugar Bush Road. South of the NWLF, the sands were removed and were used as fill material. The thickness of the water table aquifer probably averages 3 to 5 feet. The aquifer, which is situated above lacustrine silts and clays, is absent in the western portion of the NWLF. Saturated conditions within the lacustrine silts and clays occur at a depth of 12 to 14 feet BLS. It is suspected that the groundwater in both the near-surface sands and the shallow lacustrine deposits flows northward and discharges to the Tucker-Jones ditch that bounds the northern perimeter of the base.

1.2.2.7 Site 7 - East Ramp (ERMP)

Site Description:

The East Ramp is located in the southeastern portion of the base. It is bounded on the north and east by Wilbur Wright Avenue, to the south by the golf course, and to the west by the airfield. The ramp is utilized for aircraft parking, maintenance, and fueling.

Size:

75 acres.

Period of Use:

1922 - present.

Past Practices:

The East Ramp is used for aircraft parking, maintenance, and fueling. According to the Phase I report, approximately 6,000 gallons of JP-4 were spilled at an unspecified location on the East Ramp. Remedial cleanup activities were performed, but the bulk of the spill drained off the East Ramp. Base personnel have noticed a strong petroleum aroma near the East Ramp during extensive wet periods.

Summary of Phase II Stage 1 Investigation:

During the Phase II Stage 1 investigation, four groundwater monitor wells were installed into the unconsolidated formation. The wells were sampled and were analyzed for VOCs, TOC, and petroleum hydrocarbons. Petroleum hydrocarbons were detected at a maximum concentration of 9.2 mg/L, TOC at 9.8 mg/L, and trichloroethylene at 9.0 ug/L. Twelve soil samples were collected during drilling (three from each well) and were analyzed for VOCs and O&G. Oil and grease was detected in concentrations of from 69 to 229 mg/kg in all soil samples. A number of VOCs were detected including toluene, trichloroethylene, methylene chloride, 1,1,1- and 1,1,2-trichloroethane, trichlorofluoromethane, and chloroform. Trichloroethylene was the most prevalent, occurring in concentrations from 107 to 6,800 ug/g.

Groundwater occurs within the lacustrine silts and clays at a depth of 12 to 14 feet BLS beneath the East Ramp. The static water levels vary between 1.5 and 5.0 feet BLS. The hydraulic gradient is to the northeast at approximately 0.0010 feet per foot.

1.2.2.8 Site 8 - Base Coal Storage Pile (BCSP)

Site Description:

The Base Coal Storage Pile is located on the eastern portion of the base, adjacent to the Civil Engineering Complex, and north-west of the East Ramp. It is used for coal storage for use by the base coal-fired power plant.

Size:

5 acres.

Period of Use:

1922 - present.

Past Practices:

The coal pile has been used for storage of bituminous coal for use by the base coal-fired power plant.

Summary of Phase II Stage 1 Investigation:

This site was not investigated during the Phase I or the Phase II Stage 1 investigations. It was added to the list of sites for Stage 2 investigation at the request of the base staff.

1.2.3 Project Objectives

The primary objectives of the IRP Stage 2 effort are to better characterize the extent and nature of site contamination, to characterize the migration pathways, and to preliminarily identify remedial alternatives. This process includes a qualitative risk assessment as the first step in determining which sites present a threat to human health or to the environment and which sites do not. One stage of the IRP investigation has been performed, and at present, the sites are at various levels of progress toward completion of the remedial investigations. This effort is designed to meet the following objectives:

- To provide information to determine more completely the types of contaminants at each site, the environmental media (pathways) that are contaminated, and the extent of contamination.
- To develop detailed descriptions of the environmental factors that must be understood to design appropriate remedial actions.
- To perform a qualitative risk assessment identifying contamination pathways and receptors requiring additional study.
- To apply the remedial investigations and risk assessment data to the preliminary screening and remedial alternatives identification processes of the feasibility study.
- To develop "Decision Documents" for those sites that do not pose a threat to human health or to the environment, and to recommend further study where additional data are needed to perform detailed analyses of remedial actions.

1.2.4 Project Scope

The IRP Stage 2 Scope of Work for Selfridge ANGB is summarized in Table 1-2. It includes descriptions of the activities to be performed at each site. Site-specific field activities include test borings, installing monitor wells, and sampling groundwater, surface water, and soil from soil borings. Specific protocols for each activity are addressed in Section 2.

1.2.5 Project Schedule

The schedule to complete the IRP Stage 2 Scope of Work is summarized in Figure 1-2. In order to achieve the target schedule, individual activities are scheduled to overlap or to occur simultaneously as much as possible. The start of the IRP Stage 2 project began with the signing of the Delivery Order on 29 September 1987. Based on this project start date, the planned schedule for execution of field work related to this project will be as follows:

- November-December 1987: Staking of boreholes and well installations, utility clearances, and mobilization.
- December 1987: Soil borings and soil sampling, and possible surface water sampling.
- January 1988: Monitor well installation and slug tests, and possible surface water sampling.
- February 1988: Groundwater sampling, possible surface water sampling, and continuous water level recorder installation.
- March 1988: Possible surface water sampling and surveying.

The exact time of surface water sampling depends on the occurrence of specific weather conditions and can occur, therefore, anytime within the allotted time period. One preliminary Informal Technical Information Report (ITIR) and a Final Report are planned to document the results of field work, risk analyses, and remedial alternative identification. The actual Scope of Work and schedule may be revised by USAFOEHL/TS after consultation with the appropriate parties.

Table 1-2

Scope of Work Summary,
IRP Stage 2 Study,
Selfridge ANGB, Michigan

Site Designation	Scope of Work
SWLF	Monitor well installation Soil sampling Two rounds storm water sampling Groundwater sampling & slug tests Continuous water level recording
FTA-2	Soil boring and soil sampling Monitor well installation Abandonment of existing well Two rounds storm water and pond sampling Groundwater sampling & slug tests
FTA-1	Soil boring and soil sampling Groundwater sampling & slug tests
WRMP	Soil boring and soil sampling Monitor well installation Abandonment of existing well Two rounds storm water sampling Groundwater sampling & slug tests Continuous water level recording
TCLF	Soil boring and soil sampling Monitor well installation Two rounds storm water sampling Groundwater sampling & slug tests
NWLF	Soil sampling Monitor well installation Two rounds storm water sampling Groundwater sampling & slug tests
ERMP	Soil boring and soil sampling Monitor well installation Two rounds storm water sampling Groundwater sampling & slug tests Continuous water level recording
BCSP	Soil boring and soil sampling Monitor well installation Groundwater sampling & slug tests

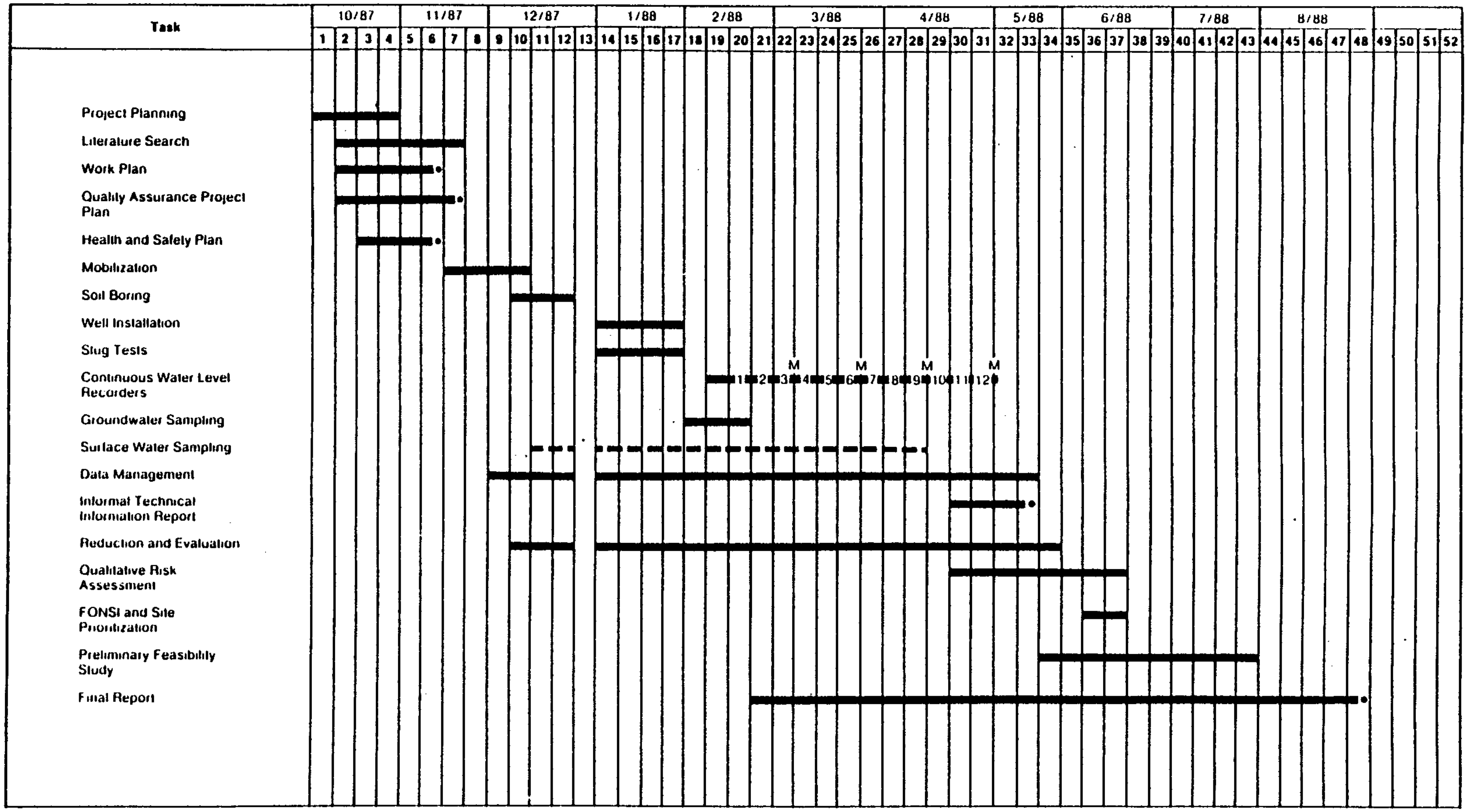


FIGURE 1-2 IRP STAGE 2, PRELIMINARY SCHEDULE, SELFRIDGE ANGB, MICHIGAN

1.3 PROJECT ORGANIZATION AND RESPONSIBILITY

The organization for this project is illustrated diagrammatically in the chart in Figure 1-3. The following is a brief description of project responsibilities.

The Program Director, Peter J. Marks, is responsible for overall management and quality assurance for the USAF IRP projects, and his responsibility also includes ensuring that all necessary corporate resources for the successful completion of the projects are provided. The Program Director also is the primary point of contact between USAFOEHL and WESTON.

The Program Manager, Katherine A. Sheedy, along with the Program Director, is responsible for technical and financial management of this project and is the direct contact individual between USAFOEHL and WESTON.

The Task Manager, Edward Need, is responsible for technical management of this task assignment including scheduling, subcontracting, communications, technical supervision, and execution of the field effort. Assisting the Task Manager are the Technical Leads for the project, the Field Supervisor, and the Data Administrator.

The Technical Leads are responsible for tracking technical progress within the project scope relating to each of their disciplines (engineering; geosciences including geology, hydrology, and soil science; and environmental sciences including biology, toxicology, and public health) and ensuring that the technical objectives of the Scope of Work are being met. The Technical Leads work with the Field Supervisor to plan data collection efforts. In addition, Technical Leads track and constantly evaluate new technical data as they are generated and notify the Task Manager of any anomalies, data gaps, and/or adjustments to the planned data collection effort which might be required to meet the technical objectives of the project.

The Field Supervisor is responsible for coordinating the activities of the field teams and directing the work of subcontractors in the field. The Field Supervisor is directly responsible for implementation of the Work Plan and the QAPP as they apply to the field effort, for keeping the field teams supplied, and for coordination of logistical issues. The Field Supervisor prepares daily field reports during all field activities and communicates progress and problem areas to the Task Manager on a daily basis. The Field Supervisor also is responsible for coordination and day-to-day contact with the base Point-Of-Contact (POC).

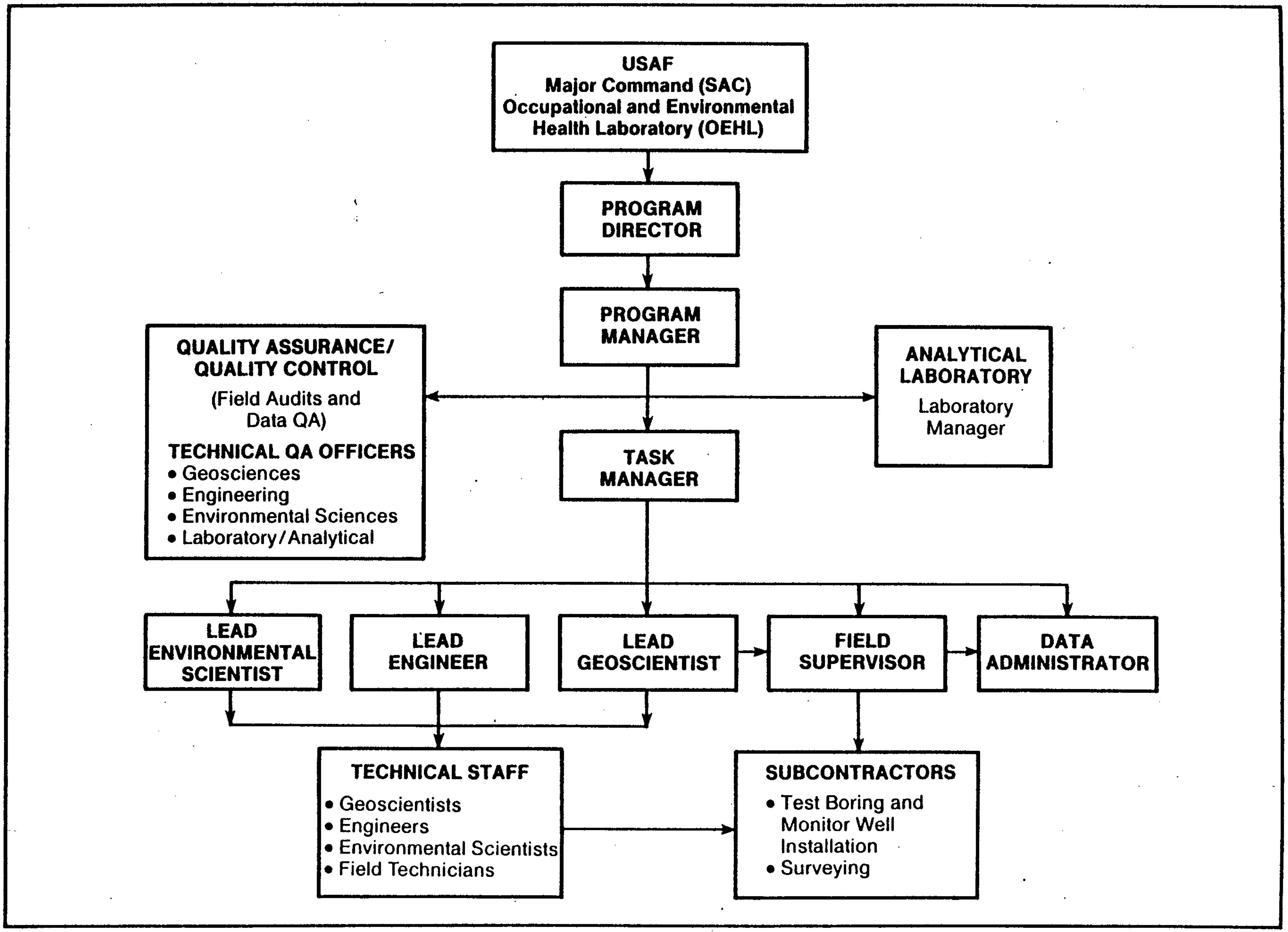


FIGURE 1-3 PROJECT ORGANIZATION, INTEGRATED IRP STAGE 2, SELFRIDGE ANGB, MICHIGAN

The Data Administrator is responsible for ensuring data validation and entering all data collected in the field into the IRPIMS data base for the project. The intent is to check all data and to enter it into the data base as it is generated. To ensure this, the Data Administrator will be present on-base during all major data collection activities. The data to be entered will include: boring and well logs, water level measurements, field water quality data, and sample point coordinate locations. In addition, the Data Administrator will assist the Field Supervisor in keeping the field teams supplied and in maintaining daily progress reports.

The Quality Assurance Officers for the project, Robert C. Brod and Dianne S. Therry, report directly to the Program Manager and Program Director. QA Officers are responsible for conducting unannounced field visits to observe data collection procedures and for periodic review of data generated. The Data Administrator or Technical Lead may request assistance from the project QA Officer in validating a data set or data analysis technique. QA Officers also are responsible for review of project deliverables.

1.4 QUALITY ASSURANCE OBJECTIVES

The overall quality assurance objective for field activities, data analyses, and laboratory analyses is to produce data of sufficient and known quality to support evaluation of environmental effects and selection of remedial alternatives. Specifically, all data will be gathered or developed using procedures appropriate for the intended use. Standard procedures will be used so that known and acceptable levels of accuracy, precision, representativeness, completeness, and compatibility are maintained for each data set. Descriptions of these criteria are presented in the following subsections.

1.4.1 Accuracy

Accuracy is the degree of agreement of a measurement, X, with an accepted reference or true value, T, usually expressed as the difference between the two values, X-T, or the difference as a percentage of the reference or true value, 100(X-T)/T, and sometimes expressed as a ratio X/T. Accuracy is a measure of the bias in a system.

The accuracy of data collected using field instruments is difficult to quantify. It can be qualitatively maximized, however, by strict adherence to standard protocols and, where applicable, manufacturers' operating and calibration procedures. This will ensure that the data are as accurate as possible and with-

in the manufacturers' reported accuracy limits. Specific procedures for instrument calibrations and field protocols are presented in Subsection 1.7.2 and Section 2, respectively.

Analytical accuracy is expressed as the percentage recovery of an analyte (or a surrogate in the case of organic analytes) which has been added to the sample (or standard matrix, e.g. a blank) at a known concentration before analysis and is expressed by the following formula:

$$\text{Accuracy} = \text{Percent recovery} = \frac{A_T - A_O}{A_F} \times 100 \text{ percent}$$

where:

A_T = Total amount found in fortified sample

A_O = Amount found in unfortified sample

A_F = Amount added to sample

1.4.2 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions."

During collection of data using field methods and/or instruments, precision is checked by reporting measurements at one location and comparing results. For example, water level measurements would be taken three times at a well and the values compared. Only if the values are within a specified percentage of each other are the measurements sufficiently precise. Specific precision goals are presented in Subsection 1.13 and Section 2.

Analytical precision is calculated by expressing as a percentage the difference between results of analyses of duplicate samples for a given analyte. Precision can be expressed by the formula:

$$RPD = \frac{C_1 - C_2}{(C_1 + C_2)/2} \times 100 \text{ percent}$$

where:

RPD = Relative Percentage Difference
C_1 = Concentration of analyte in sample
C_2 = Concentration of analyte in replicate

1.4.3 Completeness

Completeness is a measure of the relative number of data points which meet all the acceptance criteria including accuracy, precision, and any other required by the specific analytical method used.

It is usually a comparison of actual numbers of valid data points and expected numbers of valid data points which is expressed as a percentage.

Access to various areas and/or media along with unanticipated difficulties with sample collection affect field data completeness. For example, poor sample recovery in a split-spoon sample reduces the number of soil samples that can be collected and, therefore, affects the completeness.

Difficulties encountered during sample handling in the laboratory as well as unforeseen complications regarding analysis methods may affect completeness during sample analysis. For example, the analytical methods proposed for use (particularly for the organics analyses) are intended for analysis of "environmental samples" (low- and medium-level), and the applicability of these methods to unknown or hazardous-level samples may result in poor method performance and have, therefore, an adverse impact on achieving the data completeness goal.

The overall completeness goal for Stage 2 investigations at Selfridge ANGB is 90 percent.

Also, there are certain data points which are considered critical to the investigation. Critical data points are sample locations for which valid data must be obtained in order for the sampling event to be considered complete, and/or that can be expressed by a percentage of samples taken in a medium. An example of a critical data point may be an upgradient well or any other data point considered vital to the decision-making process. Critical data points for the Selfridge ANGB Stage 2 investigation will be determined in the field by the Task Manager and the Technical Lead with the Field Supervisor prior to the initiation of each applicable field activity. Because of the importance of these critical data points, the completeness goal for these points is 100 percent.

1.4.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter, variation at a sampling point, a process

condition, or an environmental condition. The methods used to select samples that are representative of the site or source will be described in the sampling protocols in Section 2.

1.4.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another. The comparability of the data is influenced by sampling and analytical procedures. By providing specific protocols to be used for obtaining and analyzing samples, data sets should be comparable regardless of who obtained the sample or performed the analysis.

1.4.6 Regulatory Requirements

Wherever possible given the analytical method specified, the limit of detection (LOD) of any chemical analysis should be less than the established Federal or state standard for the compound in the matrix analyzed in order to allow comparison of the result with that standard. Applicable Federal and State criteria for the compounds of concern (in water) at Selfridge ANGB are listed in Table 1-3.

1.5 SAMPLING PROCEDURES

In general, sampling and analysis procedures, including sample preservation and holding times for the relevant chemical analyses and matrices, will strictly comply with applicable techniques contained in the following documents:

REGULATIONS

CODE OF FEDERAL REGULATIONS

40 CFR 136.3e, Table II	Required Containers, Preservation Techniques, and Holding Times
40 CFR 136, Appendix A	Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater
40 CFR 136, Appendix B	Definition and Procedure for the Determination of the Method Detection Limit
40 CFR 136, Appendix C	Inductively Coupled Plasma - Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes Method 200.7
40 CFR 300.61 - 300.71(Subpart F)	National Contingency Plan

Table 1-3
Federal and State Regulations and Criteria for Chemicals of Concern Found at Selfridge ANGB, Michigan (Water)

	NPDWR (ug/L)		EPA-HA[4] (ug/L)			Ambient Water Quality Criteria[5] (ug/L)					
						Aquatic Life (Freshwater		Human Health			
Chemical	MCL[2]	MCLG[3]	1-Day	10-Day	Long-Term	Acute	Chronic	Drinking Water Consumption Only[10]	Fish Consumption Only[10]	CAG Potency Values[11] (mg/kg/day)	RFD[12] (mg/kg/day)
ORGANICS											
Chlorinated Aliphatics											
Chloroform	100	---	---	---	---	28,900[14]	1,240[14]	0.19[13]	15.7[13]	0.081	---
Methylene chloride	---	---	13,300	1,500	---	193,000	---	0.19	15.7	0.0075	0.06
Trichloroethene	5	0	---	---	---	45,000[14]	21,900[14]	2.7[13]	80.7[13]	0.011	---
Aromatics											
Benzene	5	0	233	233	---	5,300	---	0.66[13]	40[13]	0.052	---
Toluene	---	2,000	18,000	6,000	---	17,500[14]	---	14,300	424,000	---	0.3
Phenols											
Phenol	---	---	---	---	---	10,200[14]	2,560[14]	3,500	---	---	0.1
Polyaromatic Hydrocarbons											
Benzo(a)pyrene	---	---	---	---	---	---	---	---	---	11.5	---
Naphthalene	---	---	---	---	---	2,300[14]	620[14]	---	---	---	---
INORGANICS											
Cadmium	10	5	43	8	5	39[15]	1.1[15]	10	---	---	---
Lead	50	20	---	---	---	82[15]	3.2[15]	50	---	---	---

Table 1-3
(continued)

NOTES:

All values in ug/L, except where noted.

1. National Primary Drinking Water Regulations

2. MCLs (Maximum Contaminant Levels) are enforceable standards that will be promulgated under the National Primary Drinking Water Act. The MCL noted for chloroform is for total trihalomethanes.

3. MCLGs (Maximum Contaminant Level Goals), formerly RMCLs (Recommended Maximum Contaminant Levels), are proposed nonenforceable health goals and have been set at a level of no known or anticipated adverse health effects. MCLGs include a margin of safety for noncarcinogens, and are based on chronic toxicity data; for carcinogens, they are proposed at the zero level. Promulgated MCLs will be set at levels as close as practicable to the final MCLGs as possible.

4. EPA HA (U.S. EPA Health Advisories, formerly SNARLs) are nonenforceable criteria established by the Office of Drinking Water. They are set at levels where adverse health effects are not expected. These draft criteria consider only toxic effects, and not the cummulative effects of other chemicals in drinking water.

5. Water Quality Criteria were formulated to protect aquatic life and human health from pollutants in surface waters (40 CFR Summay, FR November 28, 1980 p. 79318-79379). Water quality criteria have no regulatory impact, but are useful in establishing water quality-based effluent limitations, water quality standards, and toxic pollutant effluent standards.

6. Guidance criteria for the protection of fresh water aquatic life. Concentrations specified should protect most (but not necessarily all) aquatic freshwater life and its uses.

7. The acute toxicity level is the maximum value to which organisms can be exposed without significant risk or adverse impact.

8. Chronic toxicity level is the 24-hour average value to which organisms can be exposed withot significant risk of adverse impact. Weekly (7.5-day) and monthly (27-day) values were established when insufficient data were available to develop a 24-hour lifetime average value. Monthly and weekly values are set at levels where organisms can be exposed over that time period with no significant risk of adverse effect.

9. Human Health Guidelines have been developed by the Office of Research and Development: UCR (Unit Cancer Risk) for carcinogens, and concentration limits (no effects or specific risk concentrations) have been established to protect a 70 kg adult against average daily consumption of contaminated drinking water and/or fish. Unless otherwise noted (see Footnote 13) these values are UCR values.

10. These adjusted criteria, for drinking water ingestion only, were derived from Human Health Guidelines for combined fish and drinking water ingestion and for fish ingestion alone. These adjusted values are not official EPA Water Quality Criteria, but may be appropriate for Superfund sites with contaminated groundwater. In the derivation of these values, intake was assumed to be 2 liters/day for drinking water and 6.5 grams/day for fish; human body weight was assumed to be 70 kg.

11. CAG potency values have been established by the Carcinogen Assessment Group for carcinogens only. Values are in $(mg/kg/day)^{1}$ and are guidance only.

12. RFD (Risk Reference Dose) is an estimate (with an uncertainty of one order of magnitude or more) of a lifetime dose which is likely to be without significant risk to human population. Values were developed by U.S. EPA Environmental Criteria and Assessment Office, Cincinnati, Ohio, in mg/kg/day. RFDs have been established independent of exposure route.

13. Value represents UCR. UCRs have been established assuming lifetime exposure and 10^{-5}, 10^{-6}, 10^{-7} risk levels. 10^{-6} is considered the representative value. Value represents concentration limit above which health would be affected through ingestion of contaminated drinking water and/or aquatic organisms.

14. Insufficient data to develop criteria. Value presented is the LOEL - Lowest Observed Effect Level.

15. Hardness dependent criteria (1000 mg/L) used.

1912B

FEDERAL REGISTER

VOL 51, NO 114, 13 June 1986	Toxicity Characteristic Leaching Procedure (TCLP)

MANUALS

ENVIRONMENTAL PROTECTION AGENCY

EPA-330/9-S1-002	NEIC Manual for Groundwater/Subsurface Investigations at Hazardous Wastes Sites
	Superfund Exposure Assessment Manual (January 1986)
EPA-540/1-86-060	Superfund Public Health Evaluation Manual (October 1986)
EPA-600/4-79-020	Methods for Chemical Analysis of Water and Wastes (1983)
SW-846	Test Methods for Evaluating Solid Waste, Third Edition (1986)

AMERICAN PUBLIC HEALTH ASSOCIATION (APHA, AWWA, & WPCF)

16th Edition	Standard Methods for the Examination of Water and Wastes

AMERICAN SOCIETY FOR TESTING AND MATERIALS

D-1452	Soil Investigation and Sampling by Auger Boring
D-1586	Penetration Test and Split-Barrel Sampling of Soils
D-2487	Unified Soil Classification System
D-2488	Recommended Practices for Visual-Manual Description of Soils
Annual Book of ASTM Standards	Section 11, Water and Environmental Technology

HANDBOOKS

ENVIRONMENTAL PROTECTION AGENCY

EPA-600/4-82-029	Handbook for Sampling and Sample Preservation of Water and Wastewater (1982)

GUIDANCE DOCUMENTS

ENVIRONMENTAL PROTECTION AGENCY

EPA-540/G-85-002	Guidance on Remedial Investigations under CERCLA
EPA-540/G-85-003	Guidance on Feasibility Studies under CERCLA

Specific methodologies to be followed, including any revisions to techniques in the above listed documents which are required by USAFOEHL or are necessary to meet the objectives of the Scope of Work, are detailed in Section 2 of this Plan.

1.6 SAMPLE CUSTODY

The purpose of sample custody procedures is to document the history of sample containers and samples (and sample extracts or digestates) from the time of preparation of sample containers through sample collection, shipment, and analysis. An item is considered to be in one's custody if:

- it is in the physical possession of the responsible party,
- it is in the view of the responsible party,
- it is secured by the responsible party to prevent tampering, or
- it is secured by the responsible party in a restricted area.

1.6.1 Chain-of-Custody

1.6.1.1 Sample Labels

All samples will be identified with a label which will be attached directly to the container. Sample labels will be completed using waterproof ink. The labels will contain the following information:

- Sample number.
- Time and date of collection.
- Installation (base) name.
- Parameters to be analyzed.
- Preservative (if any).
- Sample source/location.
- Sampler's initials.

As each sample is collected it will be placed in a labeled container. Sample numbers will have been determined before the field investigation begins. See Subsection 1.6.2.1 for a description of the sample numbering system.

1.6.1.2 Chain-of-Custody Record

To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, a chain-of-custody record will be filled out for each sample at each sampling location. Each time the samples are transferred, the signatures of the persons relinquishing and receiving the samples as well as the date and time will be documented. A sample chain-of-custody record is included as Figure 1-4.

1.6.1.3 Transfer of Custody and Shipment

Prior to shipment of samples, the chain-of-custody record will be signed and dated by a member of the WESTON field team who has verified that those samples indicated on the record are indeed being shipped. After packaging has been completed, custody seals, signed and dated by a member of the WESTON field team, will be placed on the cooler.

All samples will be shipped via courier such as Federal Express, Emery, or other overnight delivery service to the appropriate laboratory. Hazardous- or environmental-level samples may be transported by WESTON personnel in private vehicles after the samples are properly packaged and labeled. Upon receipt of the samples at the laboratory, the receiver will complete the transfer by dating and signing the chain-of-custody record.

1.6.1.4 Laboratory Custody Procedures

When sample containers are provided by WESTON, chain-of-custody documentation (see Figure 1-4) will be shipped with the sample containers. These forms should be completed by field personnel with acknowledgment of time and date of transfer and placed in the shipping container in the plastic cover provided.

The following subsections describe laboratory custody procedures associated with sample receipt, storage, preparation, analysis, and general security procedures.

Custody Transfer Record/Lab Work Request

Received By ______ Client ______ RFW Contact ______
Date ______ Client Contact ______ Date Due ______
Assigned to ______ Phone ______ Project Number ______

SAMPLE IDENTIFICATION					ANALYSES REQUESTED							
Sample No.	Client ID No.	Description	Date Collected	Container/Preservative								

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time

FIGURE 1-4 CUSTODY TRANSFER RECORD/LAB WORK REQUEST

Sample Receipt

- Upon receipt, the sample custodian will inspect sample containers for integrity. The presence of leaking or broken containers will be noted on the chain-of-custody record (see Figure 1-4). The sample custodian will sign (with date and time of receipt) the chain-of-custody record, thus assuming custody of the samples.

- The information on the chain-of-custody record will be compared with that on sample tags and labels to verify sample identity. Any inconsistencies will be resolved with the field sampling representative before sample analysis proceeds.

- Samples will be moved to one of the locked sample storage refrigerators for storage prior to analysis. The storage location will be recorded on the chain-of-custody record.

- The sample custodian will return the original chain-of-custody record to the Laboratory Data Manager and provide carbon copies to each laboratory section manager and one to the main sample log kept in the laboratory.

- The sample custodian will alert the appropriate section managers and analysts of any analyses requiring immediate attention because of short holding times.

Sample Storage

Samples will be maintained in storage in one of the locked storage refrigerators prior to sample preparation and analysis.

The storage refrigerators are maintained at 4° ± 2°C. The temperature is monitored by the laboratory security system and recorded daily in a bound log by the sample custodian. If during working hours equipment failure (compressor failure, door left open, etc.) results in the storage refrigerator temperature exceeding the upper or lower control limits, an audible alarm will sound, and the samples will be moved to suitably controlled storage until the problem has been corrected. During off working hours, the alarm is automatically transferred to security agency personnel who alert laboratory and maintenance personnel (via beeper call) so that prompt corrective action can be taken.

Analysts request samples for analysis from the sample custodian. Both sign the chain-of-custody record to acknowledge transfer of custody to the analyst.

Sample Tracking - Organic Analysis

For samples which require extraction prior to analysis, a sample extraction form is completed during the time of extraction. A copy of this form is shown as Figure 1-5.

When samples are extracted for analysis by gas chromatography, GC/MS, or liquid chromatography, all pertinent data are entered on the sample extraction form and recorded in a bound laboratory notebook. Data are entered onto the form via computer by the person performing the extraction as the extraction proceeds. A hard copy of the form is printed out and is used as the vehicle for custody transfer to the analyst. Copies are provided to the analysts to inform them that extracts are ready for analysis. The bound laboratory notebook is kept in the laboratory.

Extracts are maintained in refrigerated storage by the sample preparation section until transferred to the analysts.

Sample Tracking - Metals Analysis

Samples are received by the sample preparation section for digestion prior to analysis for metals by atomic absorption/inductively coupled plasma spectroscopy. When samples are prepared for digestion, the preparation technician fills out a sample digestion record. The type of information recorded is shown in Figure 1-6; however, computer forms will be used, but copies are not presently available.

All information regarding sample digestion is entered onto the sample digestion record via computer as the extraction proceeds and recorded in a bound laboratory notebook. The digestion record is maintained to acknowledge custody transfer of digestates to the metals analysis section. Upon completion of sample digestion, a carbon copy of the sample digestion record is provided to the metals analysis section to alert them that digestates are ready for analysis.

The bound laboratory notebook is retained by the sample preparation section.

SAMPLE EXTRACTION RECORD

Sheet No.:

Extract. Date: Extraction Batch No.: Analyst: Method:

Test: Cleanup Date: Analyst: Client:

Solvent: Adsorbent:

Sample No.:	Client ID	pH	Initial WT/VOL	Surr. Mult. 500 ul	Spike Mult. 500 ul	Final VOL ACID	Final VOL BN	Split Mult.	% Solids	C/D Factor

Comments:
Surrogate:
Spike:

Extracts Transferred	Relinquished By	Date Time	Received By	Date Time	Reason for Transfer

FIGURE 1-5 SAMPLE EXTRACTION RECORD

SAMPLE DIGESTION RECORD

Sheet No: 1 of 1

Digestion Date: Digestion Batch No: Analyst: Client:

Completion Date: Type of Prep.: Method: Matrix:

Parameters:
Type of Analysis:

Sample No:	Initial WT/VOL	Final VOL	Spike Mult.	pH <2>	% Solids	C/D FACTOR	Comments

DIGESTION CUSTODY SHEET

Extracts Transferred	Reliquished By	Date Time	Received By	Date Time	Reason for Transfer

FIGURE 1-6 SAMPLE DIGESTION RECORD

Recordkeeping

Data related to all sample preparation and analysis procedures and observations by laboratory analysts are recorded in bound laboratory notebooks which are issued by the Laboratory Quality Assurance Coordinator. Laboratory notebook pages are signed and dated daily by laboratory analysts. Corrections to notebook entries are made by drawing a single line through the erroneous entry and writing the correct entry next to the one crossed out. All corrections are initialed and dated by the analyst.

Building Security

The WESTON laboratory maintains controlled building access at all times. During working hours, all non-WESTON laboratory personnel are required to sign in with the receptionist and are escorted by laboratory personnel while in the building.

The laboratory is locked by an ADT Security System between the hours of 5:00 P.M. and 8:00 A.M. Monday through Friday and during non-working hours. This security system not only monitors building access, but also monitors the temperature in the sample storage refrigerators. If the control temperature range is exceeded during working hours, an audible alarm sounds, and during non-working hours, a silent alarm alerts ADT personnel. Response by laboratory personnel is described above.

The building is accessed by laboratory employees during non-working hours by using a key and the passcode for the building security system.

Any breach of security during non-working hours sounds a silent alarm to security agency personnel who alert the local law enforcement agency and one of three laboratory personnel via beeper call. Police response to security alarms takes place within 5 minutes, and laboratory personnel are on-site within 20 minutes.

1.6.2 Documentation

1.6.2.1 Sample Identification

A numbering system has been developed to identify each well, boring location, and sample taken during water and soil sampling programs. This numbering system provides a tracking procedure to allow retrieval of information concerning a particular sample. A listing of the sample identification numbers will be maintained by the project Data Administrator, and the Field Supervisor will ensure that it is universally applied to samples collected during this project.

This sample number will not be made available to the bench chemist performing analyses. Upon receipt by the laboratory, a sequential number will be assigned to each sample different from the sample number assigned in the field.

Each field sample number will consist of three components in conformance with the USAF IRP Information Management System (IRPIMS). The IRPIMS data base for Selfridge ANGB is currently being developed. The three components will consist of site, location, and sample identifiers as described below.

- Site Identifier - A two-digit designation will be used to identify the particular site where the sample is being collected, such as Fire Training Area 2 (Site 2).

  The site number will be cross-referenced to the actual site name in the IRP Stage 2 Work Plan and also to the sampler's field notebook. The site identifiers to be used for the Stage 2 investigation are based on the site numbering system used in earlier investigations. They are listed in Table 1-4.

- Location Identifier - A three-digit designation will be used to identify the sample location within each site such as the number of a monitor well or soil boring. Due to the high number of samples to be taken during this program, numbering sequences will start with the 100 series for shallow wells (including all existing monitor wells installed during the Stage 1 investigation); 200 series for deeper wells; 300 series for soil sample points from monitor well installations; 400 series for soil samples from soil borings; and 500 series for storm water locations.

  The numbers to be used for existing wells are summarized in Table 1-5. New monitor wells will be numbered in the order in which they are installed beginning with 126 for shallow wells and 200 for deep wells.

- Sample Identifier - A four-character alphanumeric designation will be used to identify samples according to sample type. The first character will be a letter to identify the sample type as follows:

  M - Monitor wells (groundwater)
  B - Soil borings
  W - Surface water and seeps
  H - Drum samples

Table 1-4

Summary of Site Identifier Numbers,
IRP Stage 2,
Selfridge ANGB, Michigan

Site Designation IRP Site	Site Identifier Number
Site 1 - Southwest Landfill	01
Site 2 - Fire Training Area 2	02
Site 3 - Fire Training Area 1	03
Site 4 - West Ramp	04
Site 5 - Tucker Creek Landfill	05
Site 6 - Northwest Landfill	06
Site 7 - East Ramp	07
Site 8 - Base Coal Storage Pile	08

WESTON

Table 1-5

Summary of Well Location Identifier Numbers, IRP Stage 2, Selfridge ANGB, Michigan

Site Designation	Existing Well Number	Site Designation Number	Well Location Identifier
Site 1 - Southwest Landfill	W-22	01	122
	W-23	01	123
	W-24	01	124
	W-25	01	125
Site 2 - Fire Training Area 2	W-19	02	119
	W-20	02	120
	W-21	02	121
Site 3 - Fire Training Area 1	W-16	03	116
	W-17	03	117
	W-18	03	118
Site 4 - West Ramp	W-11	04	111
	W-12	04	112
	W-13	04	113
	W-14	04	114
	W-15	04	115
Site 5 - Tucker Creek Landfill	W-5	05	105
	W-6	05	106
	W-7	05	107
Site 6 - Northwest Landfill	W-8	06	108
	W-9	06	109
	W-10	06	110
Site 7 - East Ramp	W-1	07	101
	W-2	07	102
	W-3	07	103
	W-4	07	104

The remaining three characters will be digits and will be used to provide additional information depending on the type of sample. For a monitor well or surface water sample, the three digits will indicate from which sampling round the sample came, e.g., 001, 002, etc. For a soil sample, the three digits will indicate the depth sequence from which the soil sample was obtained, e.g., 001, 002, 010 (S-1, S-2, S-10, etc.). The depth interval for that sample number will be cross-referenced in the field logs.

The sample number will not be related to date of collection; however, the date will be documented in the sampler's field log and on the chain-of-custody record. All sample numbers will also be documented by the project Data Administrator.

Provision will be made where circumstances require a slight modification to the numbering sequence for a specific sample. Two typical sample numbers follow:

- 03-118-M001 - FTA-1, Site 3 (cross-referenced in the field logs) groundwater sample collected from monitor well 118.
- 05-407-B005 - TCLF, Site 5 (cross-referenced in the field logs) soil sample S-5 taken from boring 407 at a depth of 6-7.5 feet (cross-referenced in the field logs).

The last four characters of the numbering system may be used to denote that a sample is one collected for quality control purposes (see Subsection 1.10.1). The site and location identifier will not change. The numbering system for quality control samples is explained below.

<u>Field Duplicates/Field Replicates</u>

The first character of the sample identifier will be a letter to identify the sample type as discussed above. For duplicate or replicate samples, the second character will always be the number 1 which will indicate that the sample is a duplicate of the sample denoted in the location identifier.

- 04-111-M101 - Field duplicate of the groundwater sample collected from monitor well 111, WRMP (Site 4), sampling round 1.
- 05-421-B105 - Field duplicate soil sample taken from boring 421 at TCLF (Site 5), sample S-5.

Equipment Blanks

The first character of the sample identifier will denote the sample type. The next three characters will be digits, the first of which will always be a 2 to indicate an equipment blank. The next two digits will indicate from which sampling round the sample was collected. The site and location identifiers for the equipment blank will be the numbers of the location and corresponding site which was sampled immediately prior to collecting the equipment blank.

- 04-111-M201 - Equipment blank collected during round 1 immediately after sampling monitor well 111 at WRMP (Site 4).

Trip Blanks

The first character of the sample identifier will denote the sample type. The next three characters will be digits, the first of which will always be a 3 to denote a trip blank. The next two digits will indicate from which round the sample was collected. The site and location identifiers will be the numbers of the location and corresponding site of the last sample on the chain-of-custody record.

- 04-111-M301 - Trip blank collected during round 1; 04-111 are the site and location identifiers of the last sample on the chain-of-custody record for each batch of samples taken for VOCs analysis.

Ambient Blanks

The first character of the sample identifier will denote the sample type. The next three characters will be digits, the first of which will be a 4 to denote an ambient blank. The next two digits will indicate from which round the sample was collected. The site and location identifiers will be the number of the location and corresponding site of the last sample collected at that site.

- 04-111-M401 ambient blank collected during round 1 at Site 4 (WRMP); the last well sampled at that site was monitor well 111.

1.6.2.2 Field Logs

All data collection activities performed at a site will be documented either in a field notebook or on appropriate IRPIMS forms. Entries will be as detailed and descriptive as possible so that a particular situation could be recalled without reliance on the collector's memory. All field log entries should be dated. Field notebooks will be bound books and will be assigned

to individual field personnel for the duration of their stay in the field. All IRPIMS field log forms will be kept in ring binders assigned to individual field personnel.

The cover of each notebook or ring binder will contain the following information:

- Person to whom the book is assigned.
- Project name.
- Start date.
- End date.

It will be the responsibility of all field personnel to copy (photocopy) all field logs (including notebook pages and IRPIMS forms) generated during a field day at the end of that day. Copies will be given to the on-site Data Administrator who will maintain field log files and assist the Field Supervisor in compiling daily progress reports.

1.6.2.3 Corrections to Documentation

All measurements made and samples collected will be recorded. Each field geologist/scientist will initial each page as it is completed.

If an incorrect entry is made, the data will be crossed out with a single strike mark and the mark initialed.

Any revisions to field notes will be made on the field log and will be dated and initialed by the person revising the log. There will be no erasures or deletions from the field logs.

1.6.2.4 Photographs

To the extent practicable and permissable within base security requirements, sampling locations will be photographed to provide a visual record of the conditions of the sampling area. All rolls of film will be numbered with roll number and picture number recorded in the field log book. Pictures of the sampling locations will be taken with 35-mm slide or print film. Sampling locations will be identified in the photographs by placing an 8-1/2 x 11-in. (or larger) sheet of paper with the sample and/or well number written on it next to the well or sampling point when the photograph is taken.

All rolls of film used during the project will be turned over to the on-site Data Administrator who will have them developed and will maintain a photograph file.

1.6.3 Sample Handling, Packaging, and Shipping

1.6.3.1 Sample Handling and Packaging

Samples obtained at potentially hazardous waste sites are classified as either environmental or hazardous samples. Within the environmental sample category, a distinction is made between low- and medium-concentration samples for determining both shipping procedures and appropriate analytical protocols such as dilution. These categories apply to both solid and liquid samples.

Low-level samples are considered to be those collected off-site, around the perimeter of a waste site, or in areas where hazards are thought to be significantly reduced by normal environmental processes. Medium-level samples are most often those collected on-site in areas of moderate dilution by normal environmental processes. Hazardous-level samples include samples collected from drums, surface impoundments, direct discharges, and chemical spills where there is little or no evidence of environment dilution. Hazardous-level samples are suspected to contain greater than a 15-percent concentration of any individual chemical contaminant.

Determination of the suspected concentration level of a sample is made in the field by the Field Team Leader or Field Supervisor based on the point of origin of the sample, visual evidence, evidence from TVO field screening, and past analytical results, if available.

In general, all groundwater and surface water (pond) samples at Selfridge ANGB are expected to be low-level environmental samples. Landfill leachate samples and selected soil samples from source areas are expected to be medium-level environmental or hazardous-level samples. As a conservative approach, all samples suspected of being either medium-level environmental or hazardous-level samples will be handled and shipped in the same manner as described in Subsection 1.6.3.3 below. However, whenever possible based on field data, a distinction between sample-level categories will be noted on the chain-of-custody record.

Whatever the suspected level category of a sample, the sample container will be handled with gloves and will be decontaminated in the field by rinsing off any water, preservatives, or soil residue with potable water prior to shipping.

1.6.3.2 Procedure for Packing Low-Level Environmental Samples

Samples assumed to have no- to low-concentrations of contaminants (low-level samples) will be collected in an appropriate container. The sealed and labeled container will then be placed

inside a watertight polyethylene bag. The sealed packages will then be placed inside an ice chest and packed with an absorbent packaging material such as vermiculite so as to prevent breakage. Ice will be placed on top of the samples to keep them cool during shipment. The ice chests will be sealed with a custody seal and strapping tape.

1.6.3.3 Procedures for Packing Medium-Level Environmental and Hazardous-Level Samples

Samples suspected of having medium- or hazardous-levels of contaminants will be packed according to the following procedure:

- The sample container will be placed in a separate 2-mil thick (or heavier) watertight polyethylene bag. Each sealed bag will be placed inside an appropriately sized metal can with enough noncombustible absorbent packaging material (e.g., bentonite, vermiculite, or diatomaceous earth) to prevent breakage and provide for absorption of liquid with one bag per can. The can will be pressure-closed, and clips or tape will be used to hold the lid securely. An example of this packaging is shown in Figure 1-7.

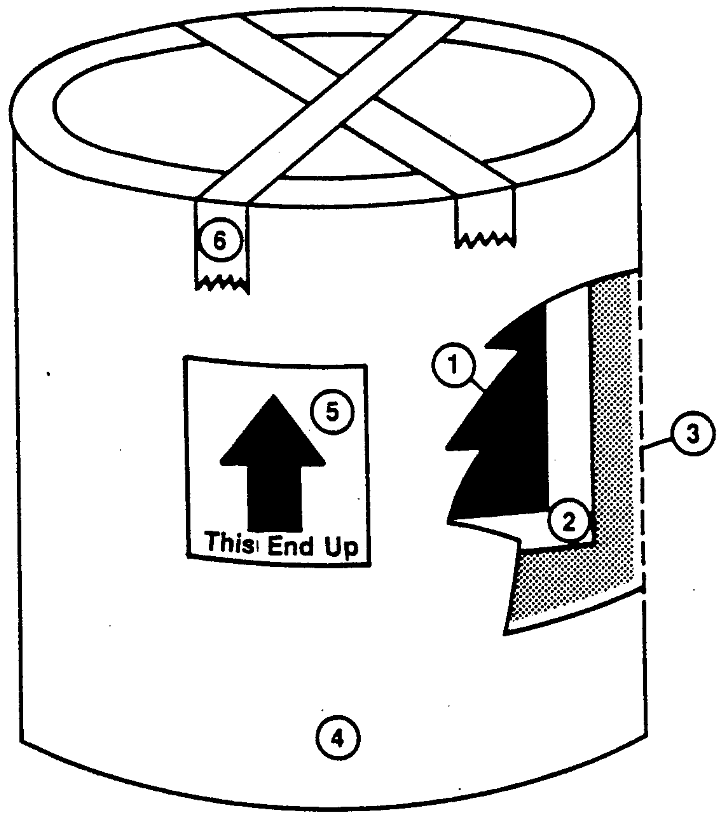
- The metal cans will be placed in a strong outside container such as an ice chest and surrounded with vermiculite or similar substitute for stability during transport. Ice will be placed on top of the samples to keep them cool during shipment. The ice chest will be sealed with a custody seal and strapping tape. The appropriate stickers, as specified by the U.S. DOT or the state DOT whichever is more stringent, will be placed on the ice chest to indicate that its contents may be hazardous. An example of the cooler labeling for medium-concentration samples is shown in Figure 1-8.

1.7 CALIBRATION PROCEDURES AND FREQUENCIES

This subsection reviews calibration procedures and frequencies for the following types of equipment:

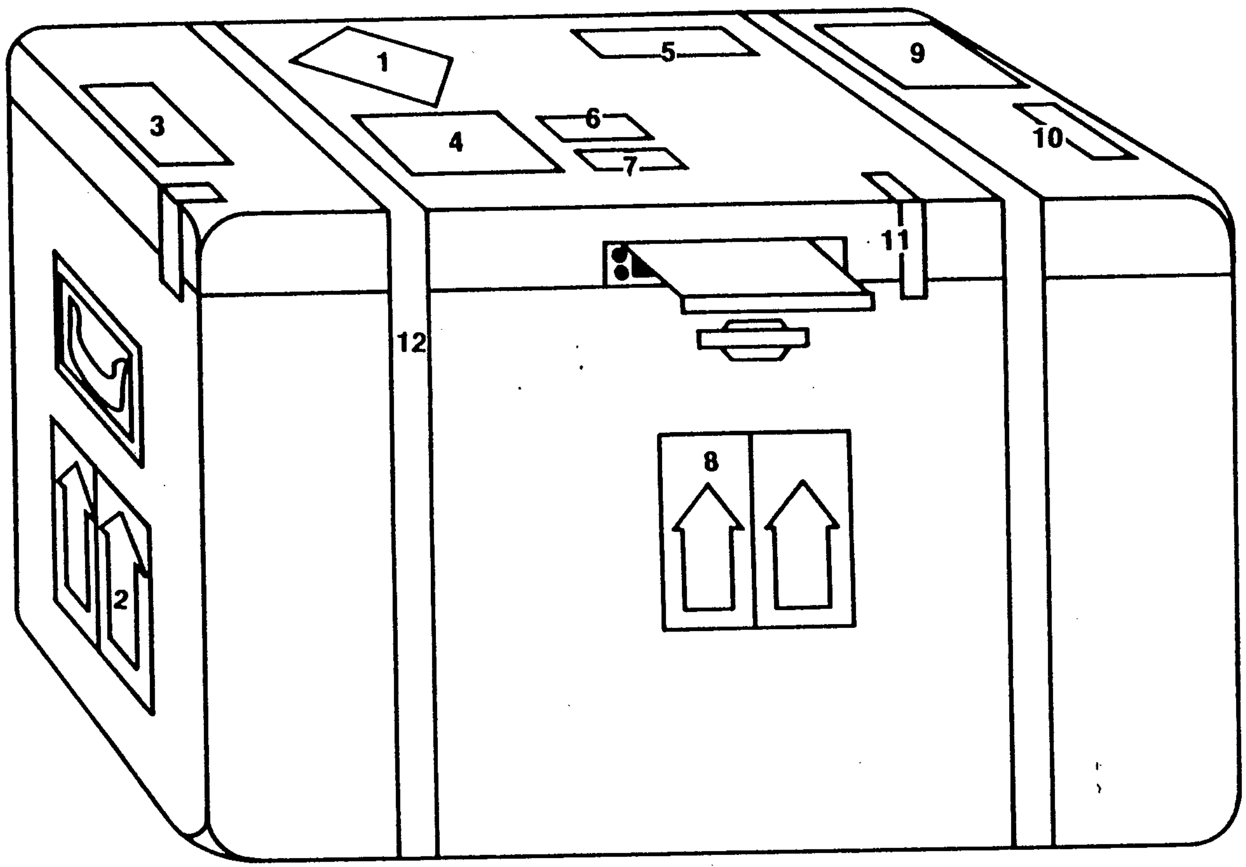
- Field equipment (including water level recorders and field water quality and field air quality screening equipment).

- Laboratory equipment (including both inorganic and organic analytical equipment).



Legend
1 Sample Container
2 Ziplock Bag (2 Mil Minimum)
3 Vermiculite (or Equivalent) Packing
4 Metal Paint Can With Lid
5 This End Up Sticker
6 Strapping Tape

FIGURE 1-7 SAMPLING PACKAGING, MEDIUM - LEVEL ENVIRONMENTAL AND HAZARDOUS - LEVEL SAMPLES



Legend

1 Flammable Liquid, N.O.S. (DOT Label)
2 Arrows Pointing Cooler in Upright Position
3 This Side Up.
4 Laboratory Address
5 Return, or Local Address
6 Flammable Liquid N.O.S.
7 UN 1993
8 Same as #2
9 Danger Cargo Aircraft Only (DOT Label)
10 Limited Quantity
11 Custody Seal (Optional)
12 Tape to Seal Cooler

FIGURE 1-8 SHIPPING CONTAINER, MEDIUM - LEVEL ENVIRONMENTAL AND HAZARDOUS - LEVEL SAMPLES

1.7.1 Field Equipment

The in-field analytical instruments to be used during the Stage 2 investigation are listed below:

- HNu Photoionization Analyzer
- Organic Vapor Analyzer (OVA)
- Combustible Gas Indicator (CGI) or Explosimeter
- MSA Samplair Pump and Gas Detector Tubes
- Gillian Low-Volume Air Samplers
- Specific Conductance Meter
- pH Meter
- Datalogger and Transducers for Water Level Monitoring
- Continuous Water Level Recorder

The instruments will be calibrated before and after each field use or as otherwise described below. Where necessary, instruments will be calibrated each day during field use.

1.7.1.1 HNu Photoionization Analyzers

The HNu photoionization analyzer is designed to measure the concentration of trace gases in many industrial or plant atmospheres. The analyzer employs the principle of photoionization for detection. A sensor, consisting of a sealed ultraviolet light source, emits photons which are energetic enough to ionize many trace species, particularly organics. In general, the instrument will be calibrated by following the listed procedures:

1. Insert one end of T tube into probe. Insert second end of probe into calibration gas in the 20-200 ppm range. The third end of probe should have the rotometer (bubble meter) attached.

2. Set the function switch in the 0-200 ppm range.

3. Crack the valve on the pressured calibration gas container until a slight flow is indicated on the rotometer. The instrument will draw in the volume required for detection with the rotometer indicating excess flow.

4. Adjust the span potentiometer so that the instrument is reading the exact value of the calibration gas. (Calibration gas value is labeled on the cylinder.)

5. Turn instrument switch to the standby position and check the electronic zero. Reset zero potentiometer as necessary.

6. Record on the form provided all original and readjusted settings as specified by the form.

7. Next, set the function switch to the 0-20 ppm. Remove the mid-range (20-200 ppm) calibration gas cylinder and attach the low-range (0-20 ppm) calibration gas cylinder as described above.

8. Do not adjust the span potentiometer. The observed reading should be ±3 ppm of the concentration specified for the low-range calibration gas. If this is not the case, recalibrate the mid-range scale repeating procedures 1 to 7 above. If the low-range reading consistently falls outside the recommended tolerance range, the probe light source window likely needs cleaning. When the observed reading is within the required tolerances, the instrument is fully calibrated.

The HNu instrument will be calibrated once per week at minimum.

1.7.1.2 Organic Vapor Analyzers (OVAs)

The Century portable organic vapor analyzer (OVA) is designed to detect and measure gases and organic vapors in the atmosphere. The instrument utilizes the principle of hydrogen flame ionization for detection. The organic vapor analyzer measures gases and vapors by producing a response to an unknown sample which can be related to a gas of known composition to which the instrument has been previously calibrated. The instrument is normally calibrated to methane gas. To calibrate the instrument, a step-by-step procedure is followed as listed below:

1. Set CALIBRATE switch to 10.

2. Adjust meter reading to zero by rotating the CALIBRATE ADJUST (zero) knob.

3. Attach one end of T assembly to calibration gas cylinder and the other to the probe.

4. Crack open calibration gas cylinder until a slight flow of gas can be detected exiting the open end of the T assembly. (Caution: if the calibration gas is toxic or highly flammable, calibration should occur inside a hood.)

5. Adjust GAS SELECT knob on instrument until the meter reads the same level as that of the calibration gas.

6. Turn off calibration cylinder and remove T assembly.

7. The instrument is now calibrated for the specialty gas/vapor. All responses of the instrument should be recorded relative to the specialty gas.

8. Calibration in the x10 range by adjusting the GAS SELECT knob automatically calibrates the instrument for the x1 and x100 ranges. No further adjustments are necessary.

9. Shut instrument down by closing the SUPPLY VALVE and TANK VALVE and putting the INSTR and PUMP switches in the OFF position.

10. Record the following on the instrument calibration label: calibration date, span gas and concentration, span setting, and initials of person performing calibration.

Calibration will be performed prior to use on a daily basis in a well-ventilated area.

1.7.1.3 Explosimeters/Combustible Gas Indicators (CGIs)

The explosimeter or combustible gas indicator (CGI) is an air monitoring device designed to indicate a flammable/explosive atmosphere and the level of oxygen present. The CGI registers combustible gas or vapors in terms of their Lower Flammability Limit (L.F.L.) which is the lowest concentration at which a combustible gas may ignite (or explode) under normal atmospheric conditions. Since the instrument measures both the level of oxygen in the atmosphere and the level a combustible gas reaches before igniting, the calibration of the instrument comprises a two-step process.

The oxygen portion of the instrument is calibrated by placing the meter in normal atmospheric air and rotating the CAL. OXYGEN control knob until the oxygen meter reads exactly 20.9 percent oxygen. This calibration will be done once daily when in use.

The combustible gas indicator is calibrated to methane at the laboratory to indicate directly the percentage L.F.L. of methane in air.

It is recommended that the gas detector be calibrated at least once every month and whenever the detector filament is replaced. The calibration kit included with the CGI contains a calibration gas cylinder, a valve attachment to release the calibration gas, flexible tubing (delivery tube), and a cylinder to encapsulate the sensor probe.

Recalibration Instructions

1. Disassemble case by removing the four retaining screws.

2. Allow the instrument to warm up for 15 minutes.

3. Assemble the calibration gas tank and delivery tube/cylinder.

4. Carefully open the valve on the gas tank to bathe the sensor with just enough gas to cause the needle on the L.F.L. meter to move.

5. Adjust the L.F.L. CAL. control screw on circuit board until the percentage L.F.L. meter indicates exactly the correct L.F.L. as indicated on the calibration gas cylinder.

Calibration in an atmosphere of combustible gases requires a source of methane test gas and a source of compressed air:

1. Using compressed air, bathe the gas sensor in a flow of air, and adjust the ZERO L.F.L. control knob.

2. Calibrate the oxygen meter by rotating the CAL. OXYGEN control knob until the oxygen meter indicates 20.9 percent.

3. Using the methane test gas, bathe the sensor in a flow of test gas and calibrate, if necessary, by adjusting the L.F.L. CAL. control screw on the circuit board.

1.7.1.4 MSA Samplair Pumps/Draeger Pumps and Gas Detector Tubes

For health and safety purposes, air sampling pumps and gas detector tubes will be used during drilling and sampling activities. For MSA universal sampling pumps, the pump filter disc should be removed and cleaned periodically by gently tapping or blowing on the surface to remove any foreign matter. Every six months the pump piston should be relubricated with high-vacuum silicone grease. Tube holders should be replaced when they show signs of wear or loss of elasticity. The test for leaks after an extended period of idleness or periodically during use is as follows.

Lock rotating head in orifice No. 4. Insert tube into tube holder. Pull handle back to lock piston into 100 cc position. Wait 2 minutes. Rotate handle to release locking mechanism. The piston should then return to the 0 cc position. If this does not occur another test should be performed. Adjust rotating head so that the locking button is positioned halfway between

any two index numbers. Lock piston into 100 cc position. Wait 2 minutes and unlock. The piston should return to the 0 cc position if the seal between the piston and cylinder is adequate.

For Draeger pumps, check pump for leaks every time it is used by sealing the pump with an unopened Drager tube and completely compressing the bellows. If the bellows has not expanded completely after 30 minutes, the pump is sufficiently air tight and will deliver the required volume. Every four weeks the wire mesh sieve under the rubber bung in the pump head must be cleaned. A special spanner is necessary to remove the rubber bung. The sieve should be taken out and cleaned with a brush under running water. Every time the pump is used it should be flushed out with air by making a few strokes without a detector tube.

1.7.1.5 Gillian Low-Volume Air Samplers

Gillian low-volume air samplers will be used to characterize gas emissions during selected drilling activities. The air samplers are calibrated daily before drilling begins. Calibration of the air samplers consists of determining the flow velocity of air through the sampler using a bubble meter as outlined below:

1. Connect bubble meter to air sampler pump via a clear tube with marked intervals.

2. Fill bubble meter reservoir with soapy liquid.

3. Squeeze bulb on bubble meter to release a bubble.

4. Turn on pump.

5. When bubble reaches the first mark on the tube, turn on stopwatch.

6. Turn off stopwatch when bubble reaches the second mark on the tube.

7. Turn off pump.

8. Record time of travel for bubble.

9. Divide the length the bubble traveled by the time of travel to obtain a flow velocity; record in field notebook.

1.7.1.6 Specific Conductance Meters

The YSI Model 33, or equivalent, is a portable battery-operated transistorized instrument used to measure salinity, specific conductance, and temperature in surface water, groundwater, and wastewater systems. The meter is calibrated daily or each time the meter is turned on (if more than once per day) by turning the MODE control to REDLINE and adjusting the REDLINE control so that the indicator lines up with the redline on the meter face.

1.7.1.7 pH Meters

The Fisher Model No. 107 pH Meter, or equivalent, is a portable pH monitoring instrument for determining pH in surface and groundwaters, waste systems, and other water quality applications.

The instrument requires field calibration daily or each time the meter is turned on (if more than once per day). Distilled water and buffer solutions (pH 7 and pH 4) are required for field calibration. All solutions must be at the same temperature to reduce meter stabilization time and to maintain accuracy. The instrument is calibrated as follows:

1. Rinse the electrode in distilled water.
2. Place the electrode in the pH 7 buffer solution and allow the meter reading to stabilize.
3. Adjust the control using the knob on the front panel of the instrument until the meter reads pH 7.
4. Rinse the electrode in distilled water.
5. Place the electrode in pH 4 solution and allow the meter readout to stabilize.
6. Adjust the control knob until the meter reads the correct value of the pH 4 solution.
7. Rinse probe in distilled water.
8. Repeat steps 2 through 7.
9. Record results in logbook.

1.7.1.8 Dataloggers and Pressure Tranducers

The In Situ SE 1000B Hermit Datalogger and a Druck Pressure Transducer will be used to record water level measurements during slug and pumping/recovery tests. The unit will be calibrated prior to initial field use on this project by adjusting the scale factor (SF) for the transducer. The SF value is equal to the transducer true full-range sensitivity in psig. For example, the 10-psig transducer may have an actual calibration sensitivity of 9.38 psig over the operating range of 4 to 20 milliatmospheres.

The scale factor will be checked and adjusted during datalogger operations, if necessary, using the following manufacturer's recommended procedure:

1. Submerge transducer at a water level below the seasonal temperature variation.

2. Accurately measure off and mark a known length on the transducer cable. For maximum accuracy this length should approximate the transducer range minus the hydrostatic head of the initial transducer setting. For example, if the transducer range is 60 meters and the initial transducer setting submerges the transducer 2 meters below the water level, the measured length should be approximately 58 meters (units of measurements need not be metric).

3. Record the water level indicated by the datalogger.

4. Lower the transducer the measured distance of step 2 to its second setting.

5. Record the water level indication for this second transducer setting.

6. Calculate the transducer scale factor using the following equation:

$$SF2 = SF1 \times \frac{L}{\Delta W}$$

where SF2 = new scale factor
L = length measured in step 2
ΔW = difference between water level indications of steps 3 and 5
SF1 = old scale factor

If the old scale factor (SF1) is unknown, substitute K from the following:

Scale Factor Verification

transducer range (meters)	K
6	10
20	50
60	100

Note:

The following factors will introduce errors when performing calibration by this technique:

1. Extreme temperature gradients related to shallow water tables, geothermal sites, etc.

2. Thermal expansion and contraction of air within the transducer cable vent tube as the cable passes between warmer and cooler environments outside and inside the well (transient error).

3. Slug effect caused by volumetric displacement of the transducer and cable in a low permeability situation.

1.7.1.9 Continuous Water Level Recorders

The Stevens Type F Water Level Recorder is an instrument that is both float-driven and time-driven. This instrument records varying levels of any liquid surface in relation to time. The rise and fall of the float with changing water levels turns the drum proportionally as the Quartz Multispeed Timer-Controlled Marker moves across the chart at a constant speed. The resulting graph shows the water level against a record of time.

Calibration of the instrument timing is done by noting the time and recording it on the chart paper at the pen location whenever the instrument is checked. The time is again noted on the chart after a sufficient interval has passed so that the chart movement can be measured. A comparison of the interval elapsed and the distance the chart has traveled will enable the operator to determine if the Quartz Multispeed Timer is moving the chart in a linear fashion. When checking the instrument for proper depth measurements, a manual water level is measured by an indicator other than the recorder. This reading is then recorded on the chart paper and is compared with the level recorded by the instrument. If the readings show a discrepancy, the recorder is adjusted so that the float and pen are properly

recording water levels. The recorder will be set to record 32-day intervals and will be checked at a minimum of every four weeks.

1.7.2 Laboratory Equipment

Before any instrument is used as a measuring device, the instrumental response to known reference materials must be determined. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. All sample measurements are made within the calibrated range of the instrument.

Laboratory instrument calibration typically consists of two types: initial calibration and continuing calibration. Initial calibration procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over that range is expressed as a correlation coefficient (e.g., for atomic absorption, inductively coupled plasma, UV-visible/infrared spectrophotometry, ion chromatography) or by a response factor, amount/response (e.g., for gas chromatography, gas chromatography/mass spectrometry, high performance liquid chromatography).

Continuing calibration usually includes measurement of the instrument response to fewer calibration standards and requires instrument response to compare with certain limits (e.g., ±10 percent) of the initial measured instrument response.

The subsections which follow identify specific instrument calibration procedures for various instruments.

1.7.2.1 Spectrophotometers

Spectrophotometers are calibrated daily before any samples are analyzed. The calibration standards are prepared from reference materials at five concentrations to cover the anticipated range of measurements and include a calibration blank. The requirement for an acceptable initial calibration is a correlation coefficient equal to or greater than 0.996. Before sample analysis, an initial calibration verification standard is analyzed. The response of this standard must be within ±15 percent of the initial calibration or the instrument must be recalibrated.

1.7.2.2 **Atomic Absorption/Inductively Coupled Plasma Spectrophotometers**

Initial Calibration

Initial calibration of atomic absorption spectrophotometers includes a calibration blank and a minimum of three calibration standards covering the anticipated range of measurement. Calibration begins with the calibration standard. The calibration curve generated must have a correlation coefficient equal to or greater than 0.996. The initial calibration is verified using a standard prepared from an independent source prior to analysis of samples. The requirement for verification is ±10 percent from the initial calibration. If it is outside these limits, the initial calibration must be repeated.

Continuing Calibration

The calibration also is verified by analysis of a continuing verification calibration standard at a frequency of 10 percent to monitor instrument drift. Therefore, a calibration standard prepared from an independent source (e.g., EPA, NBG SRUM 1643a, SPEX Industries Standards) is analyzed after every 10 samples. The response of the continuing calibration verification standard must agree with the initial calibration to within ±10 percent.

1.7.2.3 **Cold Vapor Mercury Analyzers**

Initial Calibration

The initial calibration procedures are as described in Subsection 1.7.2.2 above, except that initial calibration requires analyses of a calibration blank and five working standards. The correlation coefficient of the standard curve must be equal to or greater than 0.996. The initial calibration is verified by analysis of a calibration standard from an independent source prior to sample analysis. The response of the initial calibration verification standard must be within ± 20 percent of the initial calibration. If it is outside these limits, the instrument must be recalibrated.

Continuing Calibration

After every 10 samples a continuing calibration standard is analyzed. The response of this standard must be within ±20 percent of the initial calibration.

1.7.2.4 **Gas Chromatographs**

Initial calibration is performed with a calibration blank and five calibration standards covering the anticipated range of

measurement. The correlation coefficient of this calibration must be equal to or greater than 0.996 to consider the response linear over a range. If a correlation coefficient of 0.996 cannot be obtained, additional standards must be analyzed to define the calibration curve.

The response of the instrument is verified once every 12-hour shift by analysis of a mid-range calibration standard. The calibration check standard must be within ±20 percent of the initial calibration or the instrument must be recalibrated.

1.7.2.5 Gas Chromatograph/Mass Spectrometers

Mass spectrometers are tuned to manufacturers' specifications with perfluorotributylamine (FC-43) on a daily basis. In addition, once per shift these instruments are tuned with decafluorotriphenylphosphine (DFTPP) or 4-bromo-fluorobenzene (BFB) for semivolatiles or volatiles, respectively. Once an instrument has been tuned, initial calibration curves for analytes (appropriate to the analyses to be performed) are generated for at least five solutions containing known concentrations of authentic standards of compounds of concern. The calibration curves bracket the anticipated working range of analyses.

Calibration data, to include linearity verification determined by response factor drift (RFD) evaluation (RFD <30 percent for compounds specified), will be maintained in the laboratory's permanent records of instrument calibrations.

During each operating shift, a midpoint calibration standard is analyzed to verify that the instrument responses are still within the initial calibration determinations. The calibration check compounds will be those analytes used in the EPA Contract Laboratory Program's multicomponent analyses (e.g., priority pollutants and hazardous substances list) with the exception that benzene is used in place of vinyl chloride (volatiles) and di-n-octyl phthalate is deleted from the semi-volatiles list. The Lionville laboratory purchases calibration standards for BNAs and GC volatiles analyses from Supelco. For BNAs, these are purchased as mixtures. The volatiles standards are purchased as neat materials and are diluted as required in the GC laboratory. The GCMS laboratory uses Supelco mixes for volatiles analyses.

The Gulf Coast laboratory purchases volatiles and BNA standards from Supelco.

The response factor drift (% D, i.e., percent difference compared to the average response factor from the initial calibration) will be calculated and recorded. If significant (>30%) response factor drift is observed, appropriate corrective actions will be taken to restore confidence in the instrumental measurements.

1.8 ANALYTICAL PROCEDURES

1.8.1 Field Testing and Screening

As part of the analytical protocol for all samples, several parameters will be tested in the field. All liquid samples will be tested for temperature, pH, specific conductance (SC), and total volatile organic (TVO) vapors in sample headspace. Soil samples will be tested for TVO only. At each sampling location, a sample aliquot will be collected in a clean 8-ounce jar for the purpose of field testing. The following subsections describe the procedures for analysis of field parameters.

1.8.1.1 pH Measurement

The pH of all liquid samples will be measured using a Fisher Model No. 107 portable water pH meter (or equivalent). Before analyzing a sample, the pH meter will be calibrated and checked against the provided buffer solutions. The probe is then rinsed with distilled water and placed in the sample to be tested. One minute should be allowed for the meter to stabilize and the reading then recorded in the field log book. After the reading is taken, the probe will be rinsed with distilled water and placed in 7.0 buffer solution until its next use.

1.8.1.2 Specific Conductance (SC) and Temperature Measurement

The specific conductance and temperature of all liquid samples will be taken with a YSI Model 33 meter (or equivalent). When not in use, the probe will be placed in a jar of distilled water. Prior to placing the probe in the sample and after taking the specific conductance and temperature of the sample, the probe will be rinsed with distilled water. The temperature should be taken with the knob set on "temperature" and the specific conductance measured using the appropriate range of the "conductance" setting. One minute should be allowed for the reading to stabilize prior to recording the measurement in the field log book.

1.8.1.3 Total Volatile Organics (TVO) Measurement

The measurement of TVO in soil and water samples will be done using an Hnu Photoionization Analyzer (HNu), a Century Organic Vapor Analyzer (OVA), or equivalent. After the sample is collected, the sample jar (which should be approximately halffull) will be warmed to room temperature and then agitated. The cap will then be opened a small amount and the HNu probe placed under the cap. The highest measurement on the HNu will be recorded in the field logbook. Care should be taken so that the medium measured does not come in contact with the HNu probe.

The in-field measurement of the TVO of a sample is used for screening purposes only and is not considered a quantitative measurement. Measurement of sample TVO does not preclude collection of air TVO measurements in the breathing zone for safety purposes.

1.8.2 Laboratory Methods

Laboratory analytical methods proposed for use in this project to analyze soil and water samples are listed in Table 1-6. Appendix B contains, for each analytical method, a list of parameters to be determined and the limits of detection (LODs) for each parameter as currently required by USAFOEHL.

The limits of detection listed in Appendix B are based on instrument detection limits for clean water (with no interference). Instrument detection limits are determined by following the procedures detailed in the WESTON standard Analytical Laboratory Quality Assurance Plan (Appendix A).

Before the start of laboratory analytical work for the IRP Stage 2 investigation at Selfridge ANGB, WESTON's laboratory will compile and present to USAFOEHL a master list of instrument detection limits covering all of the methods listed in Appendix B. It is anticipated that the instrument detection limits will, in most cases, be at or below the LODs listed in Appendix B. All analytical reports for this project will reference the master list of LODs.

For inorganics analyses, the instrument detection limits are expected to be below the required LODs. Therefore the LODs provided in Appendix B will be used as detection limits for reporting purposes for inorganics analyses.

For organics analyses, the instrument detection limits for clean water are expected to be close to the LODs listed in Appendix B. The actual lower quantification limits of organic compounds in most environmental samples are expected to be higher than the LODs listed. Therefore, the Practical Quantification Limit (PQL) convention will be used for reporting of organic analytical data as recommended for specific methods and matrices in "Test Methods for Evaluating Solid Waste" (SW846, November 1986, Third Edition). Values below the stated PQLs will be qualified with a "J" to indicate the presence of a compound that meets the identification criteria but for which the concentration is less than the sample PQL which is, therefore, estimated rather than accurately quantified.

WESTON

Table 1-6

Summary of Analytical Methods, IRP Stage 2, Selfridge ANGB, Michigan

Parameter	Soil Methods	Water Methods
ORGANICS		
Volatile organic compounds	SW5030/SW8240	
Semivolatile organic compounds	SW3550/SW8270	
Extractable priority pollutants		E625
Purgeable aromatics		SW5030/SW8020
Purgeable halocarbons		E601
Petroleum hydrocarbons	SW3550/E418.1	E418.1
INORGANICS		
EP Toxicity	40CFR 261.24	
ICP metals screen (23 Metals)	SW3050/SW6010	E200.7
Arsenic	SW3050/SW7060	E206.2
Lead		E239.2
Mercury	SW7471	E245.1
Selenium	SW3050/SW7740	E270.2
Common anions (chloride, fluoride, nitrate, sulfate, orthophosphate)		A429
Nitrogen ammonia		E350.3
Alkalinity -- carbonate, bicarbonate, and hydroxide (in situ)		A403
INDICATOR PARAMETERS AND FIELD TESTS		
Total Organic Carbon (TOC)		E415.1
Chemical Oxygen Demand (COD)		A508A
Specific conductance (field test)		E120.1
pH (field test)		E150.1
Temperature (field test)		E170.1
Total Dissolved Solids (TSD)		E160.1
Acidity		E305.1
Soil moisture content	ASTM D2216	

1.9 DATA REDUCTION, VALIDATION, AND REPORTING

1.9.1 Field and Technical Data

The field and technical (nonlaboratory) data which will be collected during the Stage 2 effort at Selfridge ANGB can generally be characterized as either "objective" or "subjective" data.

Objective data include all direct measurements of field data such as field screening/analytical parameters and water level measurements. Subjective data include descriptions and observations. Test boring and well logs include both types of data in that the data recorded in the field are descriptive, but can be reduced using a standardized lithologic coding system.

1.9.1.1 Field and Technical Data Reduction

As described in Subsection 1.6.2.2, all field data will be recorded by field personnel in bound field notebooks and on the appropriate IRPIMS forms in ring binders. For example, during drilling activities, the field team member supervising a rig will keep a chronologic log of drilling activities, a vertical descriptive log of lithologies encountered, (following the Burmister System in Appendix C), other pertinent drilling information (staining, odors, field screening, atmospheric measurements, water levels, geotechnical data), and a labor and materials accounting in his/her bound notebook. Upon completion of each test boring or monitor well, an IRPIMS form will be completed that will include lithologic codes along with descriptive data. Copies of all field notes and IRPIMS forms will be turned in by field personnel on a daily basis to the Data Administrator.

After checking the data in the field notes and IRPIMS forms (see Data Validation in Subsection 1.9.1.2 below), the Data Administrator will reduce the data to tabular form, wherever possible, by entering it in data files. Where appropriate, the data files will be set up for direct input into the IRPIMS data base. For example, the IRPIMS form for a test boring or well log will be checked against the field notes and then keypunched directly to the data base. Other objective data may be set up in spreadsheet type tabular files or as two-dimensional arrays. Subjective data will be filed as hard copies for later review by the Technical Lead and for incorporation into technical reports as appropriate.

1.9.1.2 Field and Technical Data Validation

Validation of objective field and technical data will be performed at two different levels. On the first level, data will be

validated at the time of collection by following standard procedures and QC checks (e.g., triplicate measurements) specified in Section 2. At the second level, data will be validated by the Data Administrator who will review it to ensure that the correct codes and units have been included. After data reduction into tables or arrays, the Data Administrator will review data sets for anomalous values. Any inconsistencies or anomalies discovered by the Data Administrator will be resolved immediately, if possible, by seeking clarification from the field personnel responsible for collecting the data.

Subjective field and technical data will be validated by the Technical Leader who will review field reports for reasonableness and completeness. In addition, random checks of sampling and field conditions will be made by the Field Supervisor who will check recorded data at that time to confirm the recorded observations. Whenever possible, peer review also will be incorporated into the data validation process, particularly for subjective data, in order to maximize consistency between field personnel. For example, during drilling activities the Field Supervisor will schedule periodic reviews of archived lithologic samples to ensure that the appropriate lithologic descriptions and codes are being consistently applied by all field personnel.

1.9.1.3 Field and Technical Data Reporting

The type and format for technical reports to be produced during this project are described in detail in Section 6 of the Work Plan. In general, tabulations and presentation of objective data will be consistent with IRPIMS format, where appropriate, and will follow standard reporting formats required by USAFOEHL. The reporting of subjective technical data and the results of data evaluation and analysis also will follow report formats to be provided by USAFOEHL and/or Selfridge ANGB.

1.9.2 Laboratory Data

All analytical data are recorded into bound laboratory notebooks issued by the QA Coordinator. Data are recorded and associated with the unique WESTON laboratory sample identification number and the field sample identifier. For inorganic (nonmetal) analyses, the bound notebook pages are preformated for each analytical method. These pages contain the following information:

- Analytical Method
- Analyst
- Date
- Reagent Concentrations
- Instrument Settings (as applicable)
- Raw Data

The laboratory analysts sign and date all notebook entries daily. The notebook pages are reviewed periodically by the Section Manager prior to final data assembly. Copies of strip chart outputs (chromatograms, etc.) are maintained on file for five years.

1.9.2.1 Laboratory Data Reduction

At the completion of a set of analyses, all calculations are completed and checked by the analyst. The associated quality control data (blanks, blank spikes, duplicates) are entered onto quality control charts and verified to be within control limits. If all data are acceptable, the data are entered into the laboratory computer system and the data summaries (notebook pages, final concentrations) are submitted to the Section Manager for review. This is the procedure for all inorganic analytical data. For organic analytical data, summary reports are manually generated for review by the Section Manager. After approval, data are manually entered into a computer terminal (Lotus format). If QC samples do not meet acceptance criteria, the appropriate Laboratory Section Manager and the QA Coordinator are notified, and corrective action is taken as described in Subsection 1.14.2.

Acceptable data are submitted to the Laboratory Section Manager for review. After the Laboratory Section Manager approves, the Laboratory Data Manager is notified that data are ready to be reported, and the completed analyses are removed from the laboratory backlog.

The Laboratory Data Manager generates a hard copy data summary which is reviewed and signed by the Laboratory Section Manager and the Laboratory Manager.

1.9.2.2 Laboratory Data Validation

In addition to the data review performed by analysts and the appropriate Laboratory Section Manager, the Laboratory QA Coordinator audits approximately 10 percent of the data reported by the WESTON Analytical Laboratory. This audit focuses on compliance of data with laboratory quality control requirements and client contractual requirements. This audit includes selective checks on calculations, verification of the report format, and completeness of the data report package.

1.9.2.3 Laboratory Data Reporting

Laboratory data reporting will be performed via magnetic media using the tabular outputting capabilities of the IRPIMS and other standard software formats. The laboratory data reports will include sample analytical results, second column confirmation results, reportable field and laboratory QA/QC sample analytical results (as specified in Subsection 1.10), method limits of detection, and sample practical quantitation limits (PQLs).

At this time, the QA/QC reporting package for laboratory data includes results of QA/QC samples analyzed with samples from Selfridge ANGB. If samples from other projects are included in the same batch, QA/QC analyses associated with those samples will not be reported, although they will be used for Quality Control on the whole batch. Because of the reporting procedure, a particular set of samples may appear to have a larger or smaller number of QC samples than required by the QA/QC plan. This is a reporting artifact.

1.10 INTERNAL QUALITY CONTROL CHECKS

1.10.1 Internal Quality Control Checks - Field

The quality assurance effort for a field investigation program is developed to ensure and validate that inconsistencies in protocols or the field protocols themselves do not introduce error into the data collection process. To achieve this goal, standard operating procedures (SOPs) have been developed, as described in Section 2, and will be followed as consistently as possible by all field personnel given the variability of natural conditions encountered in the field. Any deviation from SOPs necessitated by unanticipated field conditions will be fully documented if they occur. An integral part of SOPs are the quality control checks which are described individually in Section 2 for each type of field method.

Specifically, field quality control checks have been introduced into the sample collection procedures in order to minimize (and identify if it occurs) the potential for interference or introduction of nonenvironmental contaminant during sample collection, storage, transport, and/or equipment decontamination. These checks are provided through collection of field quality control samples. The following types of quality control samples will be included in the IRP sampling quality assurance program:

- One trip blank will be sent to the laboratory for every 10 VOC investigative samples collected. Definition of Trip Blank: a sample bottle is filled with ASTM Type II Reagent water, is transported to the site, is handled like a sample, and is returned to the laboratory for analysis (trip blanks are not to be opened in the field). The trip blank for soils is Type II Reagent water just as in the case of water samples.

- One ambient conditions blank will be collected for every 10 VOC investigative samples collected. Definition of Ambient Conditions Blank: Type II Reagent water is poured into a sample container at the site, is then handled like a sample, and is transported to the laboratory for analysis.

- One set of equipment blanks will be collected (all parameters analyzed for every 10 investigative samples collected). Definition of Equipment Blank: Type II Reagent water is poured into the sampling device (or pumped through it in the case of sampling pumps), is transferred to the sample bottle, and is then transported to the laboratory for analysis.

- Ten percent field duplicates (all parameters analyzed) for water samples. Definition of Duplicate: two samples collected independently at a sampling location during a single act of sampling. Field duplicates shall be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are duplicates.

- Ten percent field duplicate or replicates (all parameters analyzed) for soil samples. Definition of Replicate: a single sample is collected and then divided into two equal parts for the purpose of analysis. Replicate samples are often called "splits." Field replicates shall be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are replicates.

1.10.2 Internal Quality Control Checks - Laboratory

The daily quality of analytical data generated in the WESTON laboratories is controlled by the implementation of WESTON's standard Analytical Laboratory Quality Assurance Plan (Appendix A). As specified in the plan under "Method Performance," types and frequencies of internal quality control checks have been developed for each analysis type. In general, internal laboratory QC checks will consist of the following:

- Method Blanks. Method blanks usually consist of laboratory reagent grade water treated in the same manner as the sample (i.e., digested, extracted, distilled, etc.) which is then analyzed and reported as a standard sample would be. A method blank will be run with each batch of samples received by the laboratory for analysis. The analysis of method blanks serves as a check on reagents to assure that they are free from contamination.

- Method Blank Spike. A method blank spike is a sample of laboratory reagent grade water fortified (spiked) with the analytes of interest which is prepared and analyzed with the associated sample batch. Method blank spikes are not included with VOC analyses since the same function is served by the calibration standard analysis. A method blank spike will be analyzed for each batch of 20 or fewer samples received by the laboratory.

- Matrix Spikes. A matrix spike is an aliquot of a field sample which is fortified (spiked) with the analytes of interest and analyzed with an associated sample batch to monitor the effects of the field sample matrix (matrix effects) on the analytical method. Matrix spikes are performed only in association with selected protocols, as specified in Appendix A. For each sample round, matrix spikes will be prepared once every 20 samples per matrix.

- Laboratory Duplicate Samples. Duplicate samples are obtained by splitting a field sample into two separate aliquots and performing two separate analyses on the aliquots. The analysis of laboratory duplicate monitors sample precision; however, it may be affected by sample inhomogeneity, particularly in the case of nonaqueous samples. Laboratory duplicates will be run and reported for specific analyses only, as specified in Appendix A. For each sample round, a laboratory duplicate will be run with every 20 field samples.

In addition to the quality control samples described above, three additional types of independent quality control checks (not associated with field sample batches) are routinely analyzed in the laboratory. These are the following:

- Laboratory Control Standard for Inorganics. This is a standard solution with a certified concentration which is analyzed as a sample and is used to monitor analytical accuracy. A laboratory control standard will be run for each batch of 20 or fewer samples.

- Blind Performance Sample. This is a QC sample of known concentration obtained from the U.S. EPA, the National Bureau of Standards (NBS), or a commercial source. The blind performance sample is not recognizable to the analyst as a performance sample and is used to monitor analytical accuracy. There is no set frequency for performing analysis on a blind performance sample.

- Known Performance Sample. A known performance sample is the same as a blind performance sample, but is identified to the analyst so that he/she may use it to check the accuracy of an analytical procedure. It is particularly applicable when a minor revision or adjustment has been made to an analytical procedure or instrument. Known performance samples are run with blind performance samples and there is no set frequency.

1.11 PERFORMANCE AND SYSTEM AUDITS

Audits may consist of two types - system audits and performance audits. The purpose of the systems audit is to determine whether

appropriate corporate, division, and project systems are in place. The performance audit is used to indicate whether those systems are functioning properly.

1.11.1 Technical Performance Audits

Technical performance audits will be performed on an ongoing basis during the project as field data are generated, reduced, and analyzed. All numerical analyses, including manual calculations, mapping, and computer modeling, will be documented and will be the subject of performance audits in the form of quality control review, numerical analysis, and Peer Review. All records of numerical analyses will be legible, reproduction-quality, and complete enough to permit logical reconstruction by a qualified individual other than the originator.

1.11.2 Field Performance Audits

Periodic performance audits will be conducted in the field by the appropriate technical QA Officers for the particular discipline of field activities (e.g., geoscientist to audit well drilling activities). The purpose of the field audits will be to ensure that the methods and protocols detailed in this QAPP are being consistently adhered to in the field.

Checklists will be prepared by the auditing QA Officer prior to the audit and used to ensure completeness of the review, and as a means of documenting the results of the audit. Items to be examined may, as appropriate, include the availability and implementation of approved work procedures; calibration and operation of equipment; packaging, storage, and shipping of samples obtained; and documentation procedures.

The records of field operations will be reviewed to verify that field-related activities were performed in accordance with appropriate project procedures. Items reviewed will include, but not be limited to, the calibration records of field equipment, daily field activity logs, chain-of-custody documentation, and field logs. Audits of field activities will occur at least twice during the IRP Stage 2 activities.

During an audit and upon its completion, the auditors will discuss the findings with the individuals audited and cite corrective actions to be initiated.

Minor administrative findings which can be resolved to the satisfaction of the auditors during an audit are not required to be cited as items requiring corrective action. Findings that are not resolved during the course of the audit and findings affecting the overall quality of the project, regardless of when they are resolved, will be noted on the audit checklist and the results provided to both the Project Manager and Task

Manager. The Task Manager and Field Supervisor will provide follow-up documentation to the Project Manager showing that corrective actions have been implemented.

1.11.3 Laboratory Performance Audits

WESTON participates in several external performance audits sponsored by those agencies listed in Table 1-7. These performance audits are in the form of blind performance samples submitted by the auditing agency.

The Laboratory QA Coordinator has overall responsibility for monitoring the internal Quality Assurance/Quality Control program. The QA Coordinator has a staff to provide in-house audits and to review and validate analytical data packages. The QA Coordinator is also responsible for scheduling and coordinating external systems audits and for reviewing data for performance samples received. The QA Coordinator supplies blind performance samples to the laboratory at least semi-annually.

1.11.4 Project System Audits

WESTON's Director of Quality Assurance will periodically, on an unannounced basis, call for a corporate project audit (system audit). The Project or Program Manager must respond by submitting the Project Quality Control Plan (in this case, the project QAPP) and the auditor will then determine whether the QAPP is in-place. The auditor also will determine whether the reviews called for in the Quality Control Plan have been and are being conducted. On a scheduled basis, certain projects are identified by the Director of Quality Assurance for a more formal audit. These audits evaluate in depth the implementation of the QA Program in the project as they apply to field and data analysis and reduction procedures. The Division Operations Manager, in his role as Division Quality Assurance Officer, may request the Director of Quality Assurance to perform an audit or may conduct the audit himself. One corporate project audit is anticipated for Selfridge ANGB.

1.11.5 Laboratory System Audits

WESTON participates in several external system audits sponsored by state regulatory agencies and the U.S. EPA. These system audits involve on-site evaluation of the WESTON laboratory systems. The type of audit, auditing agency, and frequency of these audits for the WESTON Analytical Laboratory are summarized in Table 1-7.

The WESTON Laboratory QA Coordinator audits systems at least once annually. The internal audit consists of a review of systems, procedures, and documentation. Any deficiencies/deviations are documented, and a summary report is prepared.

Table 1-7

Summary of External Performance and Systems Audits - WESTON Analytical Laboratories

Agency	Parameters	Type	Frequency	Purpose
Illinois EPA	WS/WP	Performance	Semi-annually[1]	Water/Waste-water Cert. Requirement
NY Department of Health	WS/WP	Performance	Semi-annually	Water/Waste-water Cert. Requirement
NY State Department of Energy Conservation	Inorganic/ Organic HSL	Performance System	Semi-annually Annually	Required for State Analytical Contract
NJ Department of Environmental Protection	WS/WP	Performance System	Annually Every 2 Yrs.	Water/Waste-water Cert. Requirement
PA Department of Environmental Resources	WS/WP	Performance System	Annually Every 2 Yrs.[1]	Water/Waste-water Cert. Requirement
U.S. EPA	Inorganic/ Organic HSL	Performance System	Quarterly Every 2 Yrs.[1]	Superfund Related Analytical Work
U.S. Army Corps of Engineers (DERA)	Inorganic/ Organic	Performance System	As Contract Requires	Water/ Wastewater Superfund Analytical Work

[1]Last on-site by U.S. EPA was performed in May 1987, last PA DER on-site was performed in May 1987, and last IEPA on-site was performed in June 1987.

WS = Water Supply (Drinking Water)
WP = Water Pollution (Wastewater)

1.12 PREVENTIVE MAINTENANCE OF EQUIPMENT

1.12.1 Field Equipment

As discussed in Subsection 1.7, the field equipment will have been properly calibrated, charged, and in good general working condition prior to the beginning of each working day.

All field instruments will be properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that will be encountered during coldweather working conditions. At the end of each working day, all field equipment will be taken out of the field and placed in a cool dry room for overnight storage.

All subcontractor equipment (e.g., drill rigs, water trucks, etc.) will arrive at the site each day in proper working condition. All lubrication, hydraulic, and motor oils will be checked by the subcontractors prior to the start of each work day to make certain all fluid reservoirs are full and there are no leaks.

Prior to the start of work each day, the WESTON Field Supervisor will also inspect all equipment for fluid leaks. If a leak is detected, the equipment will be removed from service for repair or replacement.

1.12.2 Laboratory Equipment

The ability to generate valid analytical data requires that all analytical instrumentation be properly maintained. The WESTON Analytical Laboratory maintains full service contracts on all major instruments. These service contracts not only provide routine preventive maintenance, but also emergency repair service. The elements of the maintenance program are discussed in the following subsections.

1.12.2.1 Instrument Maintenance Logbooks

Each analytical instrument is assigned an instrument logbook. All maintenance activities are recorded in the instrument log. The information entered in the instrument log includes:

- Date of service
- Person performing service
- Type of service performed and reason for service
- Replacement parts installed (if appropriate)
- Miscellaneous information

If service is performed by the manufacturer, a copy of the service record is taped into the page facing the notebook page where the above information is entered.

1.12.2.2 Instrument Calibration and Maintenance

Preventive maintenance and calibration by manufacturers' service representatives are provided on a routine basis. The maintenance procedures and frequencies for major analytical instruments are given in Table 1-8.

WESTON service agreements provide for preventative maintenance, emergency service, and emergency shipping of spare parts. For emergency response, service contracts on the gas chromatographs, GC/MS instruments, and AA/ICP require on-site response within 48-72 hours. (Typically, service representatives are on-site within 24 hours of a service call.) The service contracts also provide for 24-hour delivery of critical spare parts in response to a service request.

1.12.2.3 Spare Parts

WESTON's laboratory maintains an inventory of routinely required spare parts (including for example sources, vacuum pumps, and filaments for GC/MS torches and burner heads for AA/ICP).

The instrument operators along with the appropriate Section Manager have the responsibility to ensure that an acceptable inventory of spare parts is maintained.

1.13 DATA ASSESSMENT PROCEDURES

1.13.1 Field Data

1.13.1.1. Precision

All liquid samples will be tested for temperature, pH, and specific conductance. Field parameter and magnetometry measurements will be taken using precision procedures outlined in Section 2. These procedures are developed specifically for each individual measurement.

1.13.1.2 Accuracy

To ensure accuracy of measurement of field parameters, the field instruments will be calibrated daily to standards of known concentrations as discussed in Subsection 1.7.

WESTON

Table 1-8

Instrument Maintenance Schedule - WESTON Analytical Laboratories

Instrument	Preventative Maintenance	Service Contract
Gas Chromatograph/Mass Spectrometers	Semi-annually	Yes
Gas Chromatographs	Semi-annually	Yes
GC Detectors (FID,EC,PID,Hall,NPD,FPD)	As needed	Yes
High Performance Liquid Chromatographs	As needed	No
Atomic Absorption Spectrometers (Flame and Furnace)	Semi-annually	Yes
Inductively Coupled Plasma Spectrometers	Semi-annually	Yes
Analytical Balances	Annually	Yes
Ion Chromatographs	Annually	Yes
Spectrophotometers	As needed	No
Cold Vapor Mercury Analyzers	As needed	No
Technican Autoanalyzers	As needed	No
Conductivity Meters	As needed	No
Ovens	As needed	No
pH/Specific Ion Meters	As needed	No

1912B

1.13.1.3 Completeness

The Field Supervisor is responsible for ensuring that all equipment is functioning and calibrated properly so that all field measurements made meet the requirements for accuracy and precision. Together, the Field Supervisor and Data Administrator will review field data as it is compiled to ensure completeness.

1.13.2 Laboratory Data

The QA objectives for precision, accuracy and completeness were given in Subsection 1.4; this subsection will discuss the routine procedures used for assessment of those criteria.

1.13.2.1 Precision

The precision of analyses of replicate samples is calculated as given in Subsection 1.4.2. The precision requirements for Organic analyses are given in Table 1-9. All analytical data are reviewed relative to those criteria.

For metal and inorganic analyses, the QA objective for precision is ± 20% relative percent difference (RPD) between replicate analyses.

1.13.2.2 Accuracy

The calculation of analytical accuracy for organic compounds is as given in Subsection 1.4.1, and the criteria for assessing accuracy for surrogate recovery are those given in Table 1-10.

For metals, analytical accuracy is measured from analysis of a laboratory control standard and a sample fortified with the element of interest. The QA objectives for accuracy in metals analysis for these QC samples are:

Sample	Recovery (%)
Laboratory Control Standard	80 - 120
Fortified Sample	75 - 125

WESTON

Table 1-9

QA Objectives for Precision of Laboratory Organic Analyses

Fraction	Matrix Spike Compound*	Recovery Limits (%) Water	Recovery Limits (%) Soil/Sed	RPD Limits (%) Water	RPD Limits (%) Soil/Sed
VOC	1,1-Dichloroethene	61-145	59-172	14	22
VOC	Trichloroethene	71-120	62-137	14	24
VOC	Chlorobenzene	75-130	60-133	13	21
VOC	Toluene	76-125	59-139	13	21
VOC	Benzene	76-127	66-142	11	21
BNA	1,2,4-Trichloro-benzene	39- 98	38-107	28	23
BNA	Acenaphthene	46-118	31-137	31	19
BNA	2,4-Dinitrotoluene	24- 96	28- 89	38	47
BNA	Pyrene	26-127	35-142	31	36
BNA	N-Nitroso-di-n-propylamine	41-116	41-126	38	38
BNA	1,4-Dichlorobenzene	36- 97	28-104	28	27
Acid	Pentachlorophenol	9-103	17-109	50	47
Acid	Phenol	12- 89	26- 90	42	35
Acid	2-Chlorophenol	27-123	25-102	40	50
Acid	4-Chloro-3-methyl-phenol	23- 97	26-103	42	33
Acid	4-Nitrophenol	10- 80	11-114	50	50

* The list provided includes those compounds most commonly used for QA/QC precision control in the groups of analytes shown based on current U.S. EPA Contract Laboratory Program requirements.

WESTON

Table 1-10

QA Objectives for Accuracy (%) of Laboratory Organic Analyses

Fraction	Surrogate Compound	Recovery Limits Percentage Low/Medium Water	Low/Medium Soil/Sediment
VOC	Toluene-d_8	88-100	81-117
VOC	4-Bromo-fluorobenzene	86-115	74-121
VOC	1,2-Dichloroethane-d_4	76-114	70-121
BNA	Nitrobenzene-d_5	35-114	23-120
BNA	2-Fluorobiphenyl	43-116	30-115
BNA	p-Terphenyl-d_{14}	33-114	18-137
BNA	Phenol-d_5	10- 94	24-113
BNA	2-Fluorophenol	21-100	25-121
BNA	2,4,6-Tribromophenol	10-123	19-122

These recoveries are advisory only.

The laboratory control standard consists of reagent grade water spiked with the analyte of concern which is carried through all the steps in the analytical method. The laboratory control standard is designed to serve as a monitor of the accuracy (recovery efficiency) of the analytical method. If the laboratory control standard QA objective guidelines are exceeded, the laboratory will use established U.S. EPA guidance to assess the impact on the usability of the data as well as the need for reanalysis. For example, the U.S. EPA Contract Lab Program (CLP) has dropped the laboratory control standard control windows for silver (Ag) and antimony (Sb) due to documented difficulties in the required U.S. EPA methodology to achieve consistent and reliable recoveries.

The fortified sample is an aliquot of a field sample which is fortified (spiked) with the analytes of interest and analyzed with an associated sample batch.

The fortified sample is designed to serve as a monitor for assessing the affect of the sample matrix on measurement methodology. Established U.S. EPA guidance does not require reanalysis if the QA objective guidelines are not met.

1.13.2.3 Completeness

Completeness has been defined in Subsection 1.4.3 as a measure of the amount of analytical data of acceptable quality (i.e., data meeting all accuracy and precision criteria) generated by an analytical method or system. The minimum goal for completeness is 85 percent, and the ability to exceed this goal is totally dependent on the applicability of the analytical methods to the sample matrices analyzed (especially for organic analyses).

1.14 CORRECTIVE ACTION

1.14.1 Field Corrective Action

The initial responsibility for monitoring the quality of field measurements and observations lies with the field personnel. The Field Supervisor is responsible for verifying that all quality control procedures are followed. This requires that the Field Supervisor assess the correctness of field methods and the ability to meet quality assurance objectives. If a problem occurs which might jeopardize the integrity of the project or cause some specific quality assurance objective not to be met, the Field Supervisor will notify the Task Manager and the appropriate technical QA Officer. An appropriate corrective action will then be decided upon and implemented. The Field Supervisor will document the problem, the corrective action, and results using the form shown in Figure 1-9. Copies of the documentation form will be provided to the Task Manager and the appropriate technical QA Officer.

CORRECTIVE ACTION DOCUMENTATION

AUDIT REPORT # ____________
PAGE ___OF___

DATE/ORIGINATOR: ______________________

PERSON RESPONSIBLE FOR RESPONSE: ____________

DESCRIPTION OF PROBLEM and when identified: ______________________

State cause of problem if known or suspected: ______________________

SEQUENCE OF CORRECTIVE ACTION: (If no responsible person is identified, bring this form directly to the QA Coordinator)

State date, person, and action planned: ______________________

CA Initially Approved By: ______________________ Date: ____________

Follow-up dates: ______________________

Description of follow-up: ______________________

Final CA Approved By: ______________________ Date: ____________

RFW 21-21-006/C-2/86

FIGURE 1-9 SAMPLE CORRECTIVE ACTION DOCUMENTATION FORM

1.14.2 Laboratory Corrective Action

The initial responsibility to monitor the quality of an analytical system lies with the analyst. In this pursuit, the analyst will verify that all quality control procedures are followed and results of analysis of quality control samples are within acceptance criteria. This requires that the analyst assess the correctness of all of the following items as appropriate:

- Sample preparation procedure
- Initial calibration
- Calibration verification
- Method blank result
- Laboratory control standard

If the assessment reveals that any of the QC acceptance criteria are not met, he must immediately assess the analytical system to correct the problem. He notifies the Section Manager and QA Coordinator of the problem and, if possible, identifies potential causes and corrective action.

The nature of the corrective action obviously depends on the nature of the problem. For example, if a continuing calibration verification is determined to be out of control, the corrective action may require recalibration of the analytical system and reanalysis of all samples since the last acceptable continuing calibration standard.

When the appropriate corrective action measures have been defined and the analytical system is determined to be "in control," the analyst documents the problem, the corrective action, and the data demonstrating that the analytical system is in control. Copies of the documentation are provided to the Section Manager and QA Coordinator. A copy of WESTON's Corrective Action Documentation form is found in Figure 1-9. The critical path for assessing the correctness and acceptability of analytical data is shown in Figure 1-10.

1.15 QUALITY ASSURANCE REPORTS

1.15.1 Field QA Reports

The Task Manager will provide the appropriate technical QA Officer with daily field progress reports and compiled field data sets at weekly or monthly intervals, as appropriate. In addition, the appropriate technical QA Officer will be copied on all corrective action documentation. The appropriate technical QA Officers will perform unannounced field QA audits.

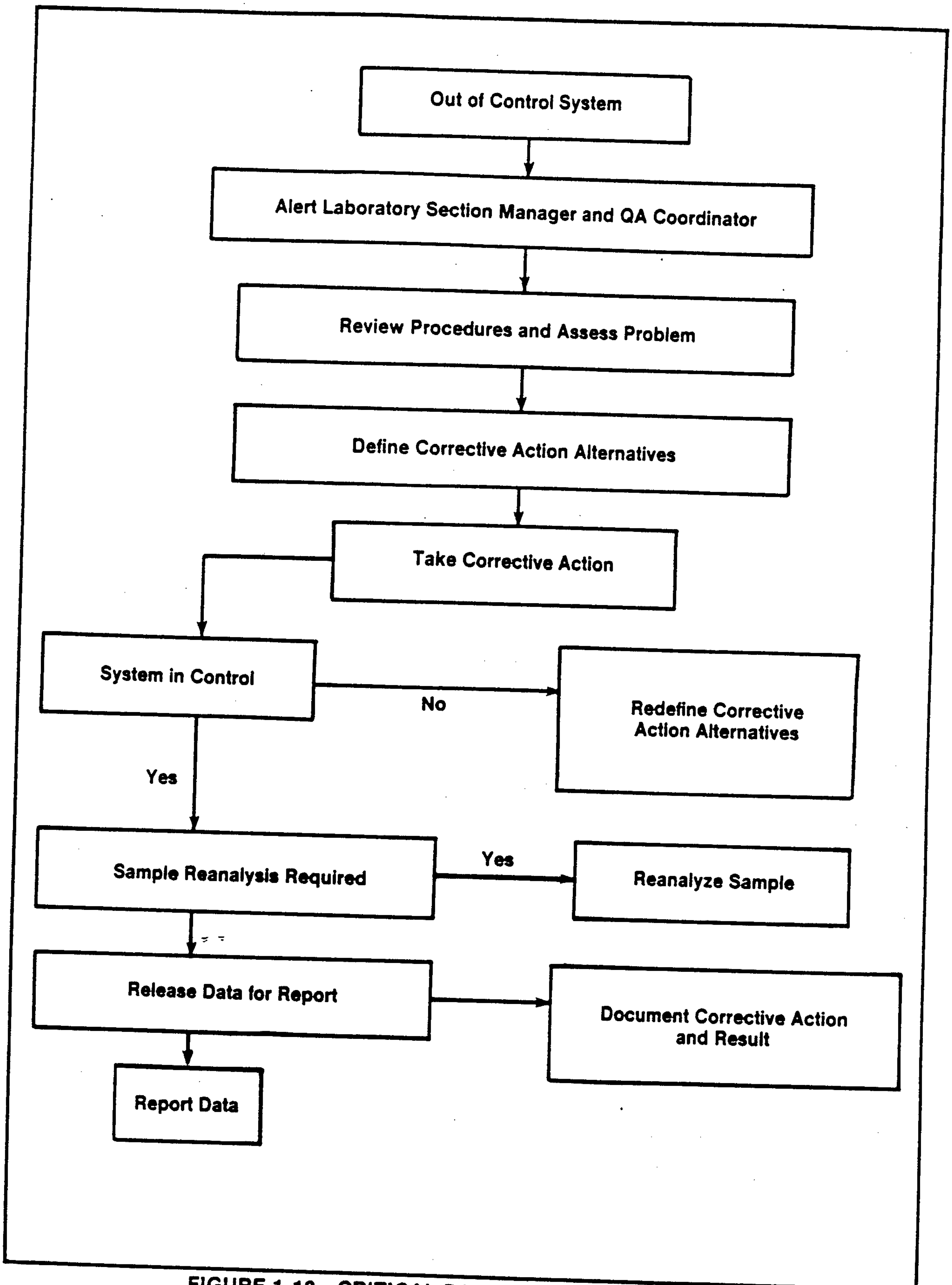


FIGURE 1-10 CRITICAL PATH FOR CORRECTIVE ACTION
WESTON ANALYTICAL LABORATORIES

On the basis of this information, each of the technical QA Officers will provide quarterly QA update memos for this project to the Project Manager. The Project Manager will be notified immediately of field QA situations requiring corrective action.

1.15.2 Laboratory QA Reports

The Laboratory QA Coordinator provides monthly, quarterly, and annual reports to the WESTON Corporate QA Coordinator. These reports summarize QA activities for the reporting period including results of performance audits (external and internal), results of system audits (external and internal), summaries of corrective action to remedy out of control situations, and recommendations for revisions of laboratory procedures to improve the analytical systems. In addition, the Laboratory Manager for this project will provide QA update memos for each sampling episode to the Project Manager upon evaluation of the analytical work for that episode. The Project Manager will be notified immediately of laboratory QA situations requiring immediate corrective action.

SECTION 2

METHODS PROTOCOLS

SECTION 2

METHODS PROTOCOLS

This section describes specific field and laboratory protocols to be applied to the IRP Stage 2 investigation at Selfridge ANGB.

2.1 TEST BORINGS AND EXPLORATORY DRILLING

Soil borings and borings for monitor well installation will be installed using 4.25-inch inner diameter (ID) hollow-stem augers (HSA) drilling techniques. Table 2-1 summarizes anticipated drilling and well construction footages. Descriptive drilling logs (see Figures 2-1 and 2-2) will be completed for each test boring and monitor well. All well/borehole cuttings will be removed where specified by the base Point-of-Contact, and the general area of the borehole will be cleaned following completion of the well/borehole. Drill cuttings suspected to be contaminated will be containerized in new, unused 55-gallon drums provided by WESTON. An HNu photoionization meter or OVA (Organic Vapor Analyzer) will be used to monitor the breathing zone during drilling operations and also to screen soil samples for total volatile organics (TVO) (see Subsection 1.8.1). Soils will be suspected to be contaminated if abnormal discoloration or odor is present or if TVO levels greater than 5 ppm above background are encountered. Drums will be sealed and marked with the well/boring number and the depths from which the suspected contaminated soil cuttings were collected. The drums will be transported to a location on the base designated by the base Point-of-Contact (POC). WESTON will be responsible for the ultimate disposal of contaminated soils. All drilling equipment will be decontaminated as described in Subsection 2.5.5.

2.1.1 Test Borings

A total of 29 soil borings will be established at the Selfridge ANGB site. The boring locations are summarized in Table 2-2. Each boring will be advanced using HSA to an average depth of 30 feet. The soil boring samples will be collected using a 5-foot CME continuous sample tube system or equivalent. The soil boring sampler will be decontaminated before each use as described in Subsection 2.5.5.

Table 2-1

Estimated Drilling and Well Construction Amounts, IRP Stage 2, Selfridge ANGB, Michigan

	Test Borings			Shallow Wells					Deep Wells				
Site	Number	Average Feet Per Hole	Total Site Footage	Number	Average Feet Per Hole	Total Site Footage	Total Site Feet Screen*	Total Site Feet Riser**	Number	Average Feet Per Hole	Total Site Footage	Total Site Feet Screen*	Total Site Feet Riser**
SWLF	--	--	--	4	15	60	40	28	4	35	140	40	108
FTA-2	3	30	90	1	15	15	10	7	--	--	--	--	--
FTA-1	3	30	90	--	--	--	--	--	--	--	--	--	--
WRMP	10	30	300	4	15	60	40	28	4	35	140	40	108
TCLF	8	30	240	3	15	45	30	21	3	35	105	30	81
NWLF	--	--	--	2	15	30	20	14	2	35	70	20	54
ERMP	2	30	60	4	15	60	40	28	4	35	140	40	108
BCSP	3	30	90	4	15	60	40	28	--	--	--	--	--
Total	29	(30 AVG)	870	22	(15 AVG)	330	220	154	17	(35 AVG)	595	170	459

*Averaging 10-foot screens.
**Riser estimates include 2 feet of stickup per well.
--No work planned.

SOIL BORING LOG

Soil Boring No.:
Location:
Client:
Project No.:
Geologist:
Equipment:
Drill Rig:
Method:
Sampling:

Dates of Drilling:
Drilled Depth:
Contractor:
Driller:
Backfill:
Material:

Depth (Feet)	Blow Counts	Description of Lithology	Comments	Moisture Content
0				
2				
4				
6				
8				
10				
12				
14				
16				
18				
20				
22				
24				
26				
28				

FIGURE 2-1 SAMPLE TEST BORING LOG

WELL LOG

Well No.:
Location:
Client:
Project No.:

Contractor:
Driller:
Helper:

Equipment:
Drill Rig:
Method:
Sampling:

Geologist:

Dates of Construction:
Drilled Depth:
Hole Diameter:

Well Depth:
Well Diameter:
Casing Type:

Screen Type:

Screen Length:
Screen Slot:

Well Construction	Depth (Feet)	Blow Counts	Description of Lithology	Comments

FIGURE 2-2 SAMPLE WELL LOG

Table 2-2

Summary of Work Plan Requirements for Monitor Wells, Borings, and Stations, IRP Stage 2, Selfridge ANGB, Michigan

Site No.	Site Name	No. of Wells Shallow	No. of Wells Deep	No. Existing Wells	No. Soil Borings	No. Storm Water Stations	No. Pond Stations	No. Groundwater Samples	No. Surface Water Samples	No. Soil Samples
1	SWLF	4	4	4	0	2	3	12	10	4
2	FTA-2	1	0	2	3	2	2	3	8	9
3	FTA-1	0	0	3	3	0	0	3	0	9
4	WRMP	4	4	4	10	4	0	12	8	30
5	TCLF	3	3	3	8	5	0	9	10	24
6	NWLF	2	2	3	0	2	0	7	4	2
7	ERMP	4	4	4	2	4	0	12	8	6
8	BCSP	4	0	0	3	0	0	4	0	9
TOTALS:		22	17	23	29	19	5	62	48	93

1913B

Soil samples will be collected for lithologic description at 2.5-foot intervals and retained in sample jars. Boring log descriptions will be prepared on-site from the core retrieved and drill cuttings using the Unified Soil Classification System and the Burmister Soil Classification System (Appendix C). Up to three soil samples will be collected at each location for laboratory analysis as described in Subsection 2.5.5.4.

If possible, the water level in the open borehole will be measured after it has stabilized. For proper abandonment, the soil borings will be grouted to the surface with a tremmie pipe using a cement/bentonite slurry. The soil boring location will be permanently marked and its location recorded on a project map.

2.1.2 Monitor Wells

A maximum of 39 groundwater monitor wells will be drilled and installed at the Selfridge ANGB. The locations of the monitor wells are summarized in Table 2-2. Nested well pairs will be established at 17 locations consisting of one shallow well and one deep well. Shallow wells will be screened such that it intersects the water table, and the total depth of the deep well will be 20 feet below the bottom of the shallow well. The five remaining wells will be completed at shallow monitor wells at five separate locations.

Where nested well pairs are to be installed, the deep well boring will be drilled and lithologically described first. This will eliminate the necessity to log the shallow well. Soil boring samples will be collected from the deep wells using a 5-foot continuous sample tube system or equivalent. Soil samples will be collected for lithologic description at 2.5-foot intervals and retained in sample jars. Boring log descriptions will be prepared on-site from the samples collected and the drill cuttings using the Unified Soil Classification System and the Burmister Soil Classification System (Appendix C). Based on HNu or OVA screening of the soil samples, a maximum of four samples will be collected for laboratory analyses during monitor well drilling at the Southwest landfill. Based on the same criteria, a maximum of two soil samples will be collected for laboratory analyses from the Northwest landfill site during monitor well drilling.

2.2 MONITOR WELL INSTALLATION AND TESTING

Shallow and deep monitor wells will be installed using the same methods. Well logs and well construction summaries will be completed for each well installed. A typical well construction diagram is shown in Figure 2-3.

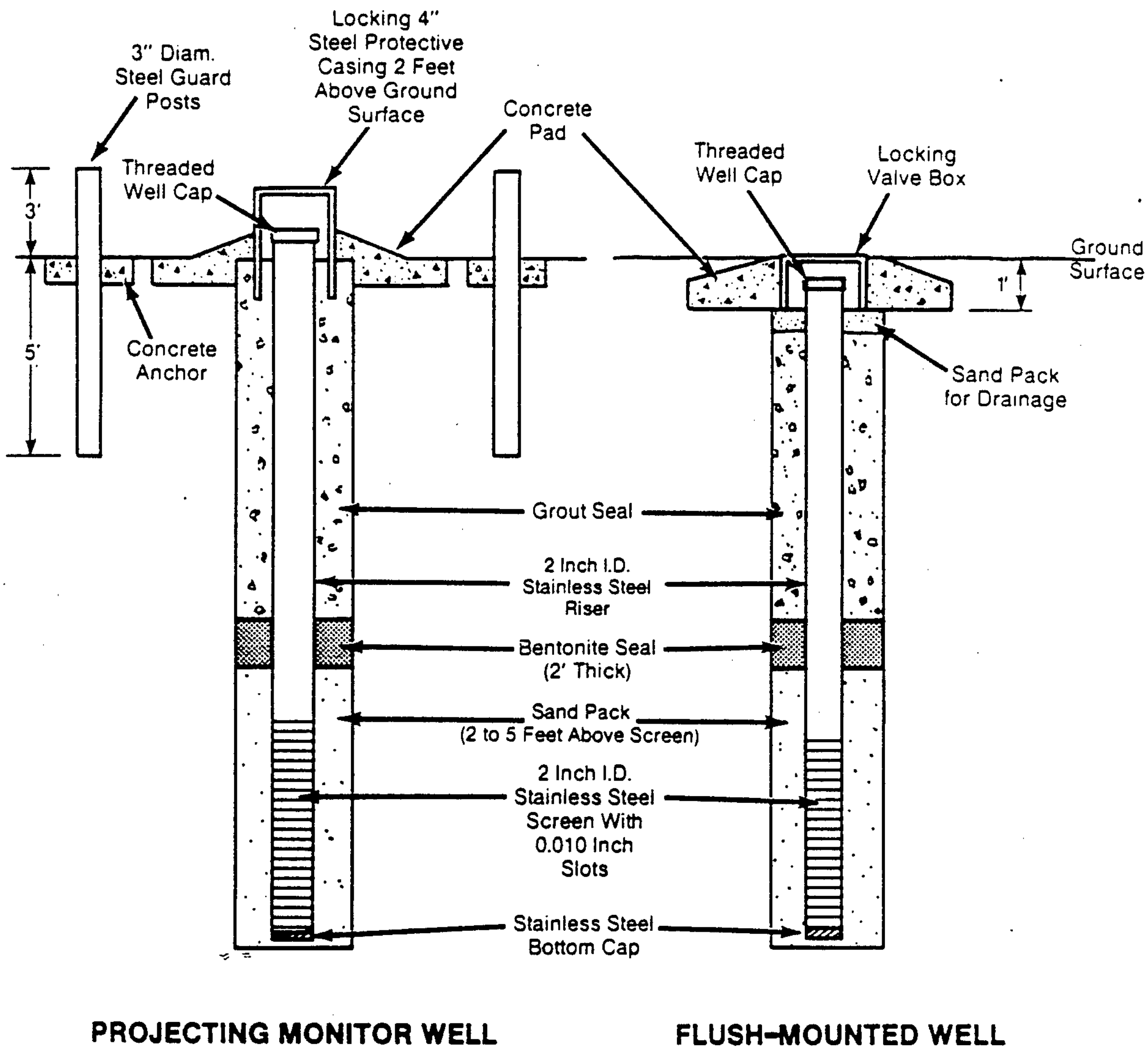


FIGURE 2-3 TYPICAL MONITOR WELL CONSTRUCTION

2.2.1 Shallow Monitor Wells

Shallow monitor well borings will be advanced to an average depth of 15 feet. The shallow wells will be installed with a 10-foot screen positioned such that 7 feet of screen are below the water table and 3 feet are above to account for possible groundwater level fluctuations. After completion of each boring, the monitor well will be constructed using 2-inch inside diameter (ID) Schedule 5, #304 stainless steel pipe with flush threaded joints and 2-inch ID Schedule 5, #304 stainless steel, 0.010-inch slot, wound well screen with a threaded bottom cap.

A medium-sand filter pack will be placed into the annular space around the well screen to a height of at least 2 feet, and no more than 5 feet above the top of the screen. Natural sand and gravel may be allowed to collapse around the screen at the discretion of the WESTON supervisor. A seal consisting of either bentonite pellets or a thick bentonite slurry will then be poured or tremmied into place above the sand pack. The bentonite seal will be a minimum of 2 feet thick. The remaining annular space will be filled with a bentonite-cement grout using a tremmie pipe. A 4- or 6-inch steel protective casing with a locking cap will be placed over the stainless steel and set in a concrete plug, except where the well is required to be finished with a valve box mounted flush with the ground surface.

All locks used will be keyed alike. A small diameter drillhole (1/4 to 3/8 in.) will be made near the bottom of each protective casing above the concrete plug to allow for drainage in the event that artesian conditions are encountered.

2.2.2 Deep Monitor Wells

Deep monitor well borings will be advanced to an average depth of 35 feet. The deep wells will be screened generally 20 feet deeper than the corresponding shallow well. After the completion of each boring, the deep monitor well will be constructed using the same methods as the shallow monitor wells, as described in Subsection 2.2.1.

2.2.3 Well Development

In order to remove cuttings from the well and to set the sand pack around the screen, wells will be developed after the grout has set (at least 48 hours after well completion). All existing wells and newly installed wells will be developed with a positive displacement pump and/or bailer. Development of the wells will continue for a minimum of 1 hour, or until the water discharged from each well is as clear and free of sediment as practical.

"Slug tests" will be performed on the existing monitor wells and the newly installed monitor wells, either concurrently with well development or as part of the first round water sampling effort. Slug tests will consist of either a singlewell minipump test, a rapid evacuation test, or a test in which a solid slug is introduced into the well. In any event, static water level will be measured in the well before testing begins.

If a minipump test is chosen, the pump will be set in the screened interval or in the open borehole, pumping will begin at the constant rate predetermined during development, and the time will be noted. Discharge (flow rate) will be measured using a bucket and a stopwatch. The well will be pumped for no more than 2 hours. Water level and elapsed time data will be collected using an automated data collection system manufactured by the In Situ Corporation. This system, the SE1000B Hermit Datalogger, is a computer-based device capable of reading and recording as many as five water level data points per second. This system has the capability to monitor two water level inputs simultaneously (wells), and can store up to 100 days of pump test data in an internal microprocessor device. This system employs Druck pressure transducers that are capable of measuring water level changes in a well to an accuracy of 0.01 of a foot.

When pumping stops, the exact time and water level in each well will be recorded on field data sheets to verify automated data collection. Recovery measurements will begin immediately using the automated equipment described above, and will continue until 90 percent of the static water level is reached, or for a minimum of 1 hour.

WESTON has developed software to transfer data stored on the SE-1000B to either an IBM-PC or a VAX mainframe computer. After the transfer takes place, the data can be edited and analyzed by a number of appropriate analytical methods.

Analytical methods for pump test data can best be determined after the data is collected and reviewed. It is anticipated that either the Jacob straight-line method or the Theis equation will be used to analyze the data and to calculate appropriate aquifer parameters. Slug tests will be performed in place of minipump tests in wells that can be completely evacuated in less than 2 minutes, and in selected other wells. Slug tests may be performed either by rapid evacuation or by introducing a solid slug into the well to displace a known volume of water. If the rapid evacuation method is used, water levels during recovery will be measured and recorded along with the time of measurement using the automated data collection equipment described above.

If the solid slug method is used, the test will be conducted by placing the pressure transducer into the screened or open portion of the well such that it will not be near the slug. The Hermit Datalogger will be set up for a test and measurements will begin immediately prior to completely submersing the slug in the well. Data will be collected until the water level reaches equilibrium. Once equilibrium is reached, the test will be stopped so the Datalogger can collect recovery water levels on a new cycle. The slug will be removed and data will be collected until the water level again reaches equilibrium.

Results collected in this manner reflect both rising head and falling head tests that can be compared as a check on the test performance.

The results of the slug tests will be analyzed according to the method developed by Bouwer and Rice (1976) or other appropriate methods.

2.2.4 Monitor Well Water Level Data Collection

The tops of the inside well casings of all monitor wells will be surveyed for elevation to the nearest 0.01 of a foot. The wells will be horizontally located to an accuracy of 1 foot, tied to the IRPIMS coordinate system, and located on the topographic site maps to be prepared for this project.

Groundwater level measurements will be taken using an electric water level probe or weighted tape in all wells prior to sampling. Measurements will be taken from a surveyed reference point marked on the top of the stainless steel well or steel risers. These data will determine the amount of water to be evacuated from each well prior to sampling (see Subsection 2.5.1). Water level measurements will be taken three times per well, or until measurements are within ± 0.01 foot. Measurements will be recorded in the field notebook and on field sampling sheets.

Elevation reference points will also be established for all surface water sampling locations. Those in manholes or catch basins will have a permanent reference point notched in the rim of the manhole.

2.3 WATER LEVEL DATA COLLECTION

When applicable, continuous water level recorders will be installed at Selfridge ANGB. These recorders will be installed to monitor groundwater diurnal effects, to obtain a data base on groundwater and surface water levels and rainfall amounts, and to estimate the hydraulic conductivity from this data using USGS Cyclic Water Level Fluctuations (Water Supply Paper 1536-I, pp. 305 to 318).

Continuous water level recorders will be installed in pairs. The first water level recorder will be installed in a storm drain. The storm drain will be surveyed for elevation and coordinates and a staff gauge will be installed. A still well will be installed to host the recorder and to reduce wave actions. A shelter will be provided for each continuous water level recorder. All installation and measurement procedures will follow USGS Techniques of Water-Resources Investigation: Stage Measurement at Gaging Station, Book 3, Chapter A7, 1968.

The second water level recorder will be installed in a sampling well close by the recorder in the storm drain. The instrumentation placed in the sampling well will be decontaminated first. A shelter will be provided for this instrument. The recorders will measure water levels for 12 consecutive weeks.

Rainfall data for the same measuring period, i.e., 12 consecutive weeks, will be obtained from the base weather detachment or other official source.

2.3.1 Continuous Water Level Recorders

Continuous water level recorders will be installed at six locations at Selfridge ANGB. The recorders will be installed in pairs. Each pair will consist of one recorder installed in a manhole and one in a nearby monitor well. Figure 2-4 is a diagram of the installations.

The installation will consists of a Stevens Type F recorder. The recorder will sit on a platform above the manhole or just over the monitor well. The recorder will be housed in a protective covering that can be secured by a padlock. The counter weight and float of the recorder will hang directly into the stainless steel casing at the monitor well installation. Two-inch ID PVC casings will be used as a still well in the manhole installation. It will be anchored to prevent the flow through the storm sewer from moving the installation. The bottom two feet of PVC casing will be slotted. The float and counter weight of the recorder on the platform will hang directly into the PVC casing from the recorder on the platform.

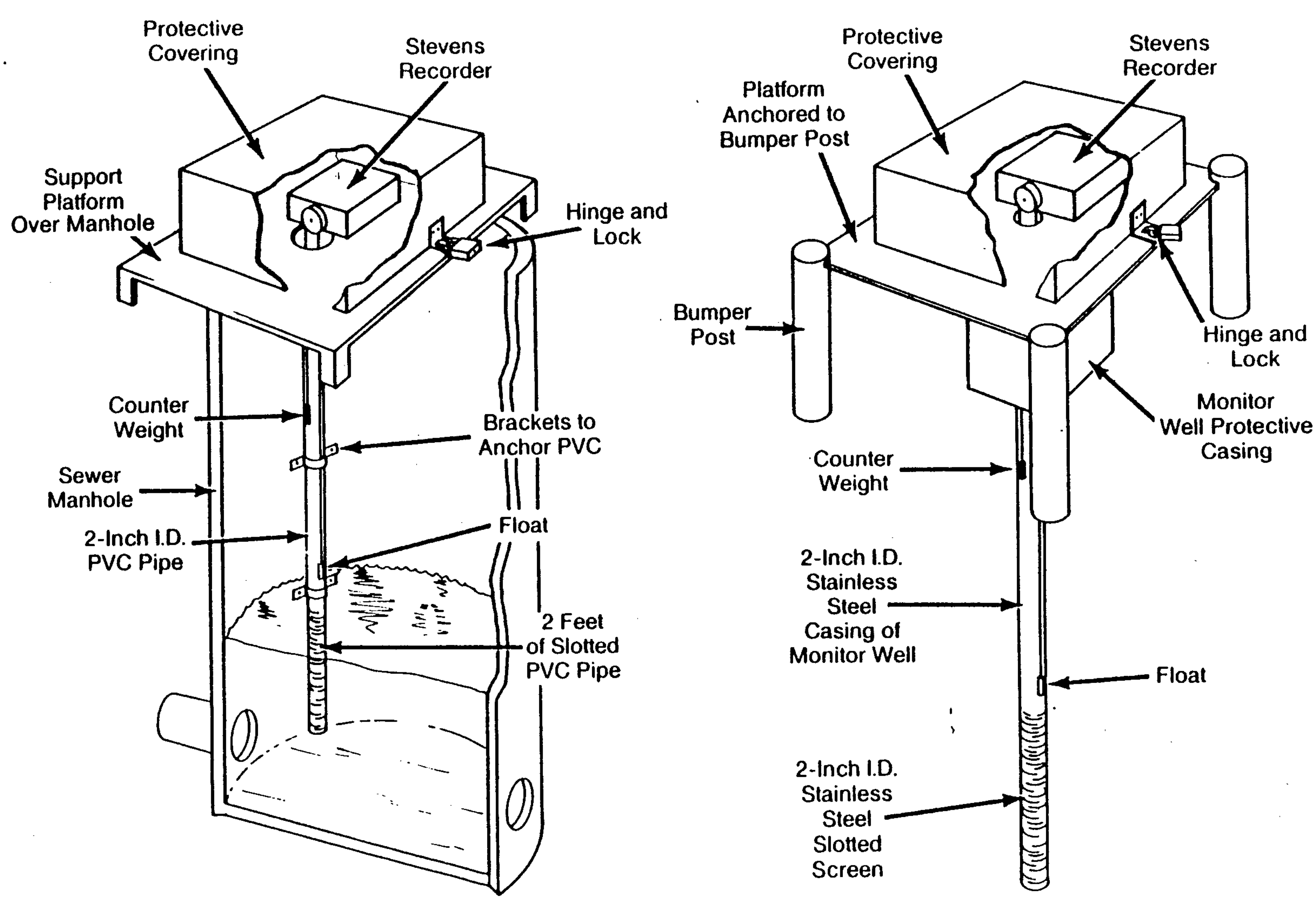


FIGURE 2-4 CONTINUOUS WATER LEVEL RECORDER INSTALLATIONS IN SEWER MANHOLE AND IN MONITOR WELLS SELFRIDGE ANGB, MICHIGAN

2.4 SURFACE WATER STATIONS

Two rounds of surface water sampling will be performed. The first round will be after a non-freezing precipitation event and the second round will be after a dry period of substantial duration. The order of the rounds is interchangeable. A maximum number of 48 surface water samples will be collected from 24 surface water stations located throughout Selfridge ANGB. The locations are described in the site-specific subsections. The surface water samples will be collected as described in Subsection 2.5.2.

2.5 SAMPLE COLLECTION

2.5.1 Groundwater Samples

As discussed in Subsection 1.8, groundwater samples will be measured in the field for pH, temperature, and specific conductance. After initially calibrating the instruments according to the methods in Subsection 1.7, measurements will be taken and the data will be recorded in the field log and on the field sampling sheet. Three sets of measurements will be taken for each parameter. If the three measurements differ by greater than 10 percent for specific conductance, 0.5 pH units for pH measurements, 1°C for temperature measurements, the instrument will be recalibrated. The instrument probes will be flushed with distilled/deionized water between sample measurements.

Groundwater sampling will be accomplished only after the wells have been properly developed. Groundwater sampling will occur no earlier than 7 calendar days after well development has been completed because drilling and well construction disturb the natural groundwater system and some time is necessary before sampling to allow the groundwater system to return to chemical equilibrium. Surface water and sediment samples will be collected during the same sampling episodes as the groundwater samples.

Upgradient wells will be sampled first at each site. Wells suspected of having low levels of contamination will be sampled prior to those suspected of having medium or high levels.

Procedures for sampling monitor wells are as follows:

- Water level measurements will be taken to the nearest 0.01 foot, with respect to the established survey point on top of the well casing. All measuring devices used in the well will be thoroughly rinsed with distilled water prior to reuse. The depth to the top of the water will be subtracted from the total casing depth to determine the height and, subsequently, the volume of standing water in the casing.

  - The surface of the water column will be examined for the presence of hydrocarbons; if present, the thickness of the hydrocarbon layer will be measured and sampled using a clear acrylic graduated bailer.

  - To ensure collection of samples representative of groundwater quality, a submersible pump or bailer will be used to remove a quantity of water from the well equal to three to five times the calculated volume of water in the well casing.

  - To collect representative groundwater samples where floating hydrocarbons are present, a "thief sampler" or other point sampler will be used to minimize the influence of free product. Otherwise, samples will be obtained using a Teflon bailer. Samples will be collected for volatile organic compounds analyses immediately after purging is complete. A separate sample will be obtained to determine pH, specific conductance, and temperature in the field.

  - Groundwater samples collected for soluble metals will be field-filtered through a 0.45-micron filter before being preserved with nitric acid.

  - All samples for chemical analyses will be placed in laboratory-prepared bottles. The bottles will be filled to the top and capped securely. Each sample bottle will be placed in an insulated cooler chest immediately after sampling. Sample handling and shipping procedures are discussed in Subsection 1.6.3.

  - All sampling equipment will be decontaminated after sampling to prevent cross-contamination between wells, as detailed in Subsection 2.5.5. Bailer line will be dedicated to each well and will consist of high-test monofiliment line, polypropylene rope, or steel wire. Sampling equipment will be protected from contamination between sampling points by wrapping in aluminum foil.

Groundwater samples will be analyzed for the parameters outlined in Table 2-3.

2.5.2 Surface Water Samples

Surface water samples will be collected by WESTON personnel from several locations around the base. Up to 24 surface water sampling locations will be established. Surface water will be analyzed for those parameters listed in Table 2-3.

Surface water samples will be collected at pond locations by submerging the sample bottles in the water. If the bottle contains a preservative, a separate clean bottle will be used to transfer the sample from the stream to the preserved bottle. Samples collected at manholes or catch basins will be obtained using a steel bucket, Kemmerer sampler, or Teflon bailer depending on site conditions. Dedicated line will be used to prevent cross-contamination. Samples will be collected so as not to cause cross-contamination; downstream samples will be collected first. Temperature, pH, and specific conductance will be measured at each sampling point in the same manner as for groundwater samples (see Subsection 2.5.1). The location of each surface water collection point will be logged in the field notebook and marked in the field and on a project map for each specific site.

2.5.3 Soil Samples

Soil samples from test borings will be collected using hollow-stem auger techniques and a continuous sample tube system, or equivalent (described in Subsection 2.1.1).

- Store in a cooler with ice or in a refrigerator before overnight shipping to laboratory.

Three samples from each boring will be retained for chemical analysis. Chemical characterization will be achieved following the protocol in Table 2-4. Samples to be collected for chemical analysis will be selected based on visual observations of staining, sheens, or other evidence of contamination, and also HNu photoionization and/or OVA meter readings. All sampling equipment and augers will be decontaminated between sampling locations, as outlined in Subsection 2.5.5.

2.5.4 Soil and Water Toxicity Sampling

If any cuttings are containerized because they are suspected of being hazardous, they will be sampled and analyzed for EP Toxicity metals (40 CFR 261.24) and for volatile organic compounds (Method SW5030/SW8240). A maximum of three composite drum samples will be analyzed.

Table 2-3

Summary of Work Plan Requirements for Laboratory Analysis of Groundwater and Surface Water IRP Stage 2, Selfridge ANGB, Michigan

Parameters	Analytical Method	Detection Limit	Reporting Unit	Number of Analyses	Dup/Rep	Amb Cond Blanks	Trip Blanks	Equipment Blanks	Second Column	Total Analyses
Alkalinity - carbonate, bicarbonates & hydroxide	A403	10	mg/L	110	11	-	-	11	-	132
Nitrogen, ammonia	E350.3	0.01	mg/L	52	6	-	-	6	-	64
Common anions (chloride, fluoride, nitrate, sulfate, orthophosphate)	A429	0.5	mg/L	110	11	-	-	11	-	132
Total organic carbon (TOC)	E415.1	1	mg/L	52	6	-	-	6	-	64
Chemical oxygen demand (COD)	A508A	5	mg/L	52	6	-	-	6	-	64
Total dissolved solids (TDS)	E160.1	10	mg/L	110	11	-	-	11	-	132
Acidity	E305.1	10	mg/L	4	1	-	-	1	-	6
Specific conductance (field test)	E120.1	-	umhos/cm	110	-	-	-	-	-	110
pH (field test)	E150.1	-	ph units	110	-	-	-	-	-	110
Temperature (field test)	E170.1	-	deg C	110	-	-	-	-	-	110
Metals screen (23 metals)	E200.7	-	mg/L	70	7	-	-	7	-	84
Arsenic	E206.2	0.005	mg/L	70	7	-	-	7	-	84
Lead	E239.2	0.005	mg/L	70	7	-	-	7	-	84
Mercury	E245.1	0.001	mg/L	70	7	-	-	7	-	84
Selenium	E270.2	0.005	mg/L	70	7	-	-	7	-	84
Petroleum hydrocarbons	E418.1	1	mg/L	106	11	-	-	11	-	128
Petroleum halocarbons	E601	-	ug/L	66	7	7	7	7	47	141
Extractable priority pollutant	E625	-	ug/L	56	6	-	6	6	-	74
Purgeable aromatics	SW5030/ SW8020	-	ug/L	106	11	11	11	11	75	225

19138

Table 2-4

Summary of Work Plan Requirements for Test Borings and Soil Sampling, IRP Stage 2, Selfridge ANGB, Michigan

	Analytical Method	SWLF	FTA-2	FTA-1	WRMP	TCLF	NWLF	ERMP	BCSP	Drill Cuttings	Total
No. of Test Borings		0*	3	3	10	8	0*	2	3		
Avg Depth of Boring		-	30 ft	30 ft	30 ft	30 ft	-	30 ft	30 ft		
Maximum No. of Samples		4	9	9	30	24	2	6	9		
<u>Parameters</u>											
Petroleum hydrocarbons	SW3550/E418.1	4	9	9	30	24	2	6	-		84
Metal screens (23 metals)	SW3050/SW6010	4	9	9	-	24	2	-	9		57
Arsenic	SW3050/SW7060	4	9	9	-	24	2	-	9		57
Mercury	SW7471	4	9	9	-	24	2	-	9		57
Selenium	SW3050/SW7740	4	9	9	-	24	2	-	9		57
VOCs	SW5030/SW8240	4	9	9	30	24	2	6	-	5	89
Semivolatile organic compounds	SW3550/SW8270	4	9	9	-	24	2	-	9		39
EP Toxicity	40CFR 261.24	-	-	-	1	-	-	1	-	2	4
Soil moisture content	ASTM D2216	4	9	9	30	24	2	6	-	5	89

*Zero soil borings drilled. Samples taken from borings for monitor well installation.

1913B

The associated drums of purge and development water will also be sampled and analyzed for EP Toxicity Metals (40 CFR 261.24) and for volatile organic compounds (Method SW5030/SW8240). A maximum of two samples will be analyzed from the drummed purge and development water. Composite samples will be collected from the drums by hand augering through the soil in the drum to collect a representative cross-section. Soil from the auger will be placed in a tray and mixed thoroughly. Samples for volatile organic compounds will be collected first, and all samples will be transferred to the appropriate bottles using stainless steel spatulas and trowels. Where several drums are filled from one boring, one composite sample may be collected for that boring. Sampling equipment will be decontaminated as detailed in Subsection 2.8.6. The base POC will be notified of the results of the analysis a maximum of 1 week after verifying the results.

2.6 DECONTAMINATION PROCEDURES

All material and equipment will arrive on site in clean condition. Recommended procedures for equipment decontamination, described in the subsections below, will be followed where applicable.

2.6.1 Drilling, Soil Sampling, and Monitor Well Installation Equipment Decontamination

Prior to the start of drilling, all drill rods, augers bits, tank, and split-spoons will be steam-cleaned at an area set up on-site for this purpose.

Augers, tools, drill rods, casings, and screens will be inspected to ensure that residue such as muds and machines oils have been removed. Similar decontamination procedures will be implemented between each boring to prevent cross-contamination and to ensure the integrity of soil samples.

2.6.2 Well Development and Pump Test Equipment Decontamination

Submersible pumps or similar equipment used for well development will be decontaminated between wells. Pumps will be decontaminated by submerging the pump intake first in a washing solution (non-phosphate type detergent), then in clean potable water, and then pumping the solutions through the pump and line.

2.6.3 Water Level Measurement Equipment Decontamination

Water level indicators used for determining water levels in the wells will be decontaminated by flushing the electrical probe with ASTM Type II Reagent water. Pressure transducers will be decontaminated by rinsing in ASTM Type II Reagent water prior to and after each use. If floating product or high levels of organic contamination are evident in a well, the decontamination procedure for sampling equipment (Subsection 2.5.5.4) will be used, except that no solvents will be used to clean pressure transducers.

2.6.4 Water and Soil Sampling Equipment Decontamination

Bailers used for water sampling, as well as other miscellaneous sampling equipment (continuous sample tubes, split-spoons, spatulas, trowels), will be decontaminated between sampling points. Pumps used for well purging will be decontaminated by submerging the pump intake first in a washing solution (laboratory-grade detergent), then in clean potable water, and then pumping these solutions through the pump system until the discharge is free of detergent.

The procedure for decontaminating sampling equipment is as follows:

- Place dirty equipment, (e.g., bailers, pumps, buckets, etc.) on a plastic ground sheet at the head of the "decon line."
- Rinse equipment in a tub of potable water to remove surface dirt and mud, if necessary.
- Scrub equipment with a bristle brush in a basin filled with laboratory-grade detergent and potable water.
- Rinse off soap in a tub of potable water.
- Rinse with ASTM Type II Reagent water.
- Rinse with pesticide-grade methanol.
- Final rinse with pesticide-grade hexane.
- Allow equipment to dry before use.
- Sampling equipment used to collect samples for organic analyses will not be allowed to come into contact with any type of plastic after decontamination.

2.7 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, HOLDING TIMES, AND SAMPLE VOLUMES

All samples submitted for analysis on this project will be collected by WESTON personnel. Sampling containers and preservatives will be provided upon request by WESTON Analytical Laboratories. The specific requirements for sample containers, preservatives, and analytical holding times are discussed in the following subsections.

2.7.1 Sample Containers

All containers provided by WESTON will be obtained from I-Chem, Hayward, California, the bottle contractor to the U.S. EPA Contract Laboratory Program. The containers provided are those described in 40 CFR Part 136, No. 209, 26 October 1984, page 28. These containers are cleaned by I-Chem in accordance with U.S. EPA protocols. The containers purchased from I-Chem are I-Chem Series 200 containers. Each lot of these containers is analyzed in accordance with I-Chem quality control requirements and is not shipped by I-Chem unless the QC requirements are met. The types of containers provided for the analytes of interest are listed in Table 2-5, along with the holding times and preservatives required for each analysis.

All sample containers provided by WESTON will be shipped with chain-of-custody records (see Subsection 1.6). These chain-of-custody records will be completed by the field sampling personnel and returned with the samples.

2.7.2 Sample Preservation

The preservatives required for all analyses will be provided by WESTON with the sample containers. The required preservation methods for target analyses are listed in Table 2-5. Preservation requirements for all other analyses will be in accordance with those given in 40 CFR Part 136, No. 209, 26 October 1984.

2.7.3 Holding Times

The holding times for all required analyses are measured from the time of sample collection and are given in Table 2-5.

Holding times for analytes not listed in Table 2-6 will be those given in 40 CFR Part 136, No. 209, 26 October 1984.

WESTON

Table 2-5

Sample Containers, Sample Volumes, Holding Times, and Preservation, IRP Stage 2, Selfridge ANGB, Michigan

Aqueous Samples

Analyte	Container	Volume	Preservation	Maximum Holding Time[1]
Petroleum Halocarbons	G, w/Teflon-lined Silicone Rubber Septum	2 x 40 ml	Cool, 4°C[2]	14 days
Extractable Priority Pollutants	G, Amber, Teflon-lined Cap	2 x 1 L	Cool, 4°C	7/40[3]
Metals	P, Teflon-lined Cap	1 L	HNO_3 pH<2, Cool, 4°C[4]	180 days[5]
Common Anions (chloride, fluoride, sulfate, phosphate)	P, Teflon-lined Cap	1 L	None, Cool 4°C	28 days
Nitrate/Nitrite	P, Teflon-lined Cap	250 ml	H_2SO_4 pH<2 Cool, 4°C	28 days
Alkalinity	P, Teflon-lined Cap	250 ml	Cool, 4°C	14 days
Nitrogen, Ammonia	P, Teflon-lined Cap	500 ml	H_2SO_4 pH <2, Cool, 4°C	28 days
TOC	G, Amber, Teflon-lined Cap	125 ml	H_2SO_4 pH<2 Cool, 4°C	28 days
COD	P, Teflon-lined Cap	250 ml	H_2SO_4 pH<2 Cool 4°C	28 days

G = Glass
P = Plastic
[1]This is the maximum holding time from date of collection.
[2]If samples contain residual chlorine, preserve by adding 0.008 percent sodium thiosulfate solution.
[3]Extraction within 7 days, analyses within 40 days of extraction.
[4]If samples contain residual chlorine, add 0.6g ascorbic acid.
[5]Mercury holding time is 28 days.
[6]Where possible, soil VOC samples will be collected in brass tubes.
[7]Samples for BNAs, pesticides, herbicides, metals, cyanide, and petroleum hydrocarbons analyses will be collected in the same 500-ml jar.

Table 2-5
(continued)

Aqueous Samples				
Analyte	Container	Volume	Preservation	Maximum Holding Time[1]
TDS	P, Teflon-lined Cap	250 ml	Cool, 4°C	7 days
Acidity	P, Teflon-lined Cap	250 ml	Cool, 4°C	14 days
Total Petroleum Hydrocarbons	G, Teflon-lined Cap	1 L	H_2SO_4 pH<2, Cool, 4°C	28 days

Soil Samples				
Analyte	Container	Volume	Preservation	Maximum Holding Time[1]
Volatile Organic Compounds (VOCs)	G, w/Teflon-lined Silicone-Rubber System[6]	2 x 40 ml	Cool, 4°C	14 days
Semi-Volatile Organic Compounds	G, Amber, wide-mouth Teflon-lined Cap	500 ml[7]	Cool, 4°C	7/40[3]
Metals	G, Amber wide-mouth, Teflon-lined Cap	500 ml[7]	Cool, 4°C	180 days[5]
Total Petroleum Hydrocarbons	G, Amber wide-mouth, Teflon-lined Cap	500 ml[7]	Cool, 4°C	28 days
EP Toxicity Metals	G, Amber wide-mouth, Teflon-lined Cap	500 ml	Cool, 4°C	NA

G = Glass
P = Plastic
[1]This is the maximum holding time from date of collection.
[2]If samples contain residual chlorine, preserve by adding 0.008 percent sodium thiosulfate solution.
[3]Extraction within 7 days, analyses within 40 days of extraction.
[4]If samples contain residual chlorine, add 0.6g ascorbic acid.
[5]Mercury holding time is 28 days.
[6]Where possible, soil VOC samples will be collected in brass tubes.
[7]Samples for BNAs, pesticides, herbicides, metals, cyanide, and petroleum hydrocarbons analyses will be collected in the same 500-ml jar.

Upon sample receipt at the WESTON laboratory, all sample collection dates are noted by the sample custodian. The required date for completion of analysis (or extraction) is noted on the chain-of custody record and is keyed to the holding time. All analyses that have holding times of 48 hours or less are identified by the sample custodian, and the appropriate Laboratory Section Manager and analyst are notified that the samples are in-house.

2.8 SAMPLING QA/QC PROTOCOLS

Field QA/QC samples will be collected and analyzed as part of all field sampling activities, including soil, groundwater, and surface water sampling. The number of field QA/QC samples to be collected are detailed in Subsection 1.10.1. The sample identifier numbers for QA/QC samples are outlined in Subsection 1.6.2.1. The following protocols will be followed for the collection of QA/QC samples.

Trip blanks will be prepared in the laboratory, shipped to the site with the sample bottles, and handled as a sample. One trip blank will be sent to the laboratory for every ten VOC samples (both soils and water) collected.

Ambient conditions blanks will be collected for every ten water samples that are collected for VOC analyses. These samples will be collected by pouring ASTM Type II Reagent water into a sample bottle. These blanks will be handled as samples and shipped back to the laboratory with the other VOC samples from that site or zone.

Equipment blanks will be collected for every ten groundwater samples collected and will be analyzed for the same parameters as the groundwater. These samples will be collected by pouring ASTM Type II Reagent water through the sampling device (e.g., bailer) and into the appropriate sampling container. Equipment blanks for soluble metals will be run through the filtering apparatus exactly as the groundwater samples.

Field duplicates will be collected for water samples. The number of field duplicates will equal 10 percent of the total number of samples. A field duplicate will be collected as a separate sample immediately after the collection of the field sample for which it is a duplicate. Collection procedures for field duplicates are identical to those for the original samples.

Field replicates will be collected for soil/sediments samples. The number of field replicates will be equal to 10 percent of the total number of samples. Replicates will be collected by placing the soil in a stainless steel tray and dividing the soil into two equal parts with a stainless steel trowel. One-half of the soil is placed in the appropriate jars labeled for the soil sample, and the other half is placed in the appropriate jars labeled for the replicate sample.

Duplicate groundwater samples will be collected from separate bailerfuls of groundwater extracted from the same well after pumping. Duplicate surface water samples will be collected as separate grab samples from the same location, one immediately after another. In continuous sample tube or equivalent soil sampling, replicate soil samples will be collected from the same sample tube by dividing apart and transferring the soil into the respective containers.

2.9 SITE MANAGEMENT

The basic components of site management in support of the IRP Stage 2 planned field activities are described in the subsections below.

2.9.1 General Operations and Coordination with USAF

The base Point-of-Contact (POC) on this project will be of the Base Bioenvironmental Engineering Office. All coordination with other parties on-base will be performed by WESTON through the POC and the Technical Program Monitor, USAFOEHL, Brooks AFB, Texas. All contacts from outside parties concerning this project will be made either through the POC or the Base Public Affairs Officer (see the Community Relations Plan, Appendix D).

The Field Supervisor will be responsible for the day-to-day coordination of WESTON field teams and subcontractors, as well as the day-to-day contact with the POC. The POC will be responsible for arranging personnel and vehicle passes for WESTON and subcontractor personnel, for locating utilities, and for coordinating issuance of digging permits for all sites designated for subsurface investigations.

For each field activity involving more than one person, a Field Team Leader will be designated by the Field Supervisor in agreement with the Task Manager from among the WESTON personnel present on-base. The Field Team Leader will be responsible for coordinating the activities of his/her team, including subcontractors, and for notifying the Field Supervisor of progress and/or logistical problems.

2.9.2 On-Base Project Facilities

An on-site office and indoor storage space will be provided by the base for the duration of the field portions of this project. The office will be equipped with a telephone and electrical utilities. It will be used as a central meeting point for planning field activities, daily debriefings, and in case of contingencies or emergencies, it will serve as a field office for the Field Supervisor and Data Administrator. In addition, it will contain dry storage space for the staging of field equipment and sampling containers, as necessary.

2.9.3 Site Access and Security

It is anticipated that all field work will be performed within the boundaries of Selfridge ANGB. Access to Selfridge ANGB is limited to Air Force military and civilian personnel, dependants, and authorized visitors. Travel within base boundaries is restricted to authorized personnel. In most cases, the individual IRP sites are not fenced.

During actual field operations, access to working areas will be limited to WESTON and subcontractor personnel and visitors authorized by the POC. All visitors will be requested to keep clear of field activities. If the presence of visitors nonetheless creates a situation believed to be dangerous by the WESTON Field Team Leader for that operation, all work will be terminated until appropriate working conditions can be restored. If necessary, the Field Team Leader will notify the Field Supervisor, who will notify the POC.

2.9.4 Site Logistics

All water for field operations (except where ASTM Type II Reagent water is specified) will be obtained from on-base drinking water sources to be specified by the POC. In general, water for drilling operations will be supplied from the nearest base fire hydrant.

Decontamination of drilling and sampling equipment will be performed either in source areas at each site or in the centralized paved decontamination area to be designated by the base POC, whichever is logistically and technically appropriate. The centralized decontamination area will drain to an oil/water separator and through the separator to a sanitary sewer. The base POC will be responsible for arranging pickup and disposal of any waste oil that may accumulate in the separator. All decontamination will be performed using water from a base potable supply, except where ASTM Type II Reagent water is specified (for sampling equipment only).

Electricity will be provided by the base to the field office and the decon area. Electricity for all remote field operations will be provided from portable generators to be supplied by WESTON if necessary.

2.9.5 Contingencies

In the event that any unforeseen circumstances arise during the course of the field activities that would endanger anyone on-site, the site shall be vacated and both the Task Manager and POC will be notified. Due to the nature of the contaminants found on the site, it is not anticipated that a fire or explosive conditions will be a problem. In an emergency, all personnel will be evacuated to the nearest point of safety, and if possible, will regroup at the field office.

Wherever appropriate, the provisions of the project Health and Safety Plan (provided under separate cover) will be followed in an emergency.

APPENDIX A

ANALYTICAL LABORATORY QUALITY ASSURANCE PLAN

ROY F. WESTON, INC.

NOVEMBER 1987

ANALYTICAL LABORATORY QUALITY ASSURANCE PLAN

Table of Contents

1.0 PURPOSE

Establish routine operating practices to ensure that all data generation in the laboratory conform to specific requirements for accuracy, precision, and completeness. The purpose and goal of quality assurance/quality control (QA/QC) is to ensure that all data generated in the laboratory conform to specific requirements for accuracy, precision, and completeness. This quality assurance/quality control plan describes the organization and procedures routinely incorporated into all analyses performed by the WESTON laboratory for the purpose of producing reliable data.

2.0 DISCUSSION

Customized, client-specific quality control measures (to include project-specific quality assurance/quality control plans) can be added to these basic guidelines to satisfy the special needs of individual programs. Laboratory personnel are available to discuss the design, advantages, and disadvantages of other quality control options.

This plan has been prepared in accordance with "Guidelines and Specifications for Preparing Quality Assurance Program Plans," QAMS-004/80, 20 September 1985.

3.0 ORGANIZATION

3.1 Laboratory Manager

The ultimate responsibility for the generation of reliable laboratory data rests with the Laboratory Manager. The Laboratory Manager is vested with the authority to effect those policies and procedures to ensure that only data of the highest attainable caliber are produced.

3.2 Section Managers

To assist the Laboratory Manager in achieving his goals, the Organic Section Manager, Inorganic Section Manager, and Support Section Manager as well as the laboratory Quality Assurance/Quality Control Coordinator and analytical project managers are responsible for the implementation of the established policies and procedures. They possess the authorities commensurate with their responsibilities for the day-to-day enforcement and monitoring of laboratory activities.

Section Managers have the responsibility for ensuring that their personnel are adequately trained to perform analyses, that equipment and instrumentation under their control are calibrated

and functioning properly, and that system audits are performed on a periodic basis. These system audits will include the analysis of external check samples to determine the analyst/instrument capability to identify and quantify routine analytes.

3.3 Quality Assurance/Quality Control Coordinator

The Quality Assurance/Quality Control Coordinator has the responsibility for the conduct of and evaluation of results from system audits. In addition, the preparation of standard operating procedures and quality assurance documentation for the laboratory is a function of the Quality Assurance/Quality Control Coordinator. The Quality Assurance/Quality Control Coordinator will review program plans for consistency with organizational and contractual requirements and will advise appropriate personnel of inconsistencies.

3.4 Laboratory Personnel

Any effective quality assurance and quality control program depends not only on organization and management but also on the efforts of each and every individual on the laboratory staff. The initial review for acceptability of analytical results rests with the analysts conducting the various tests. Observations made during the performance of an analytical method may indicate that the analytical system is not in control. Analysts must be constantly aware for indications of perturbations from the norm and be ready to verify that the system is in control before continuing analyses or reporting results of analyses.

4.0 SAMPLE MANAGEMENT

An organized and efficient sample management system is a necessary and critical foundation on which actual analyses of samples are based. Sample management includes client file creation, bottle preparation, sample preservation, sample receipt, sample storage, chain-of-custody documentation, reporting and invoicing, and sample retention and disposal.

4.1 Client File

On notification of a sampling and analysis effort, the laboratory will create a client file to maintain records associated with the project. In addition to administrative information (work order and plan numbers, client contacts, etc.), requests for sample containers, preservatives, and required analyses will be included in the file. As the project progresses, chain-of-custody and analytical results as well as any other pertinent information will be added to the file.

4.2 Bottle Preparation and Sample Preservation

On request by the Project Manager, sample bottles will be prepared by the laboratory and made available to the sampling team. The bottles will be prepared according to WESTON standard operating procedures and will include sample preservatives appropriate to the analytes and matrices of concern. Addition of preservatives to samples shall be recorded in field notebooks and on chain-of-custody forms. WESTON adheres to the most recent recommendations from the U.S. Environmental Protection Agency (EPA) for proper sample containers and preservatives.

If sample bottles are not supplied by the laboratory, the client assumes responsibility for bottle selection and preparation.

4.3 Chain-of-Custody

Chain-of-custody procedures document the history of samples and constitute a crucial part of sampling and analysis programs. Chain-of-custody documentation assists and enables the identification and tracing of a sample from the time of collection through the time of analysis.

When sample bottles are supplied by the laboratory, chain-of-custody forms will accompany the containers to the field. As samples are collected, entries are made on the chain-of-custody forms. Data to be noted include:

- Date
- Samples
- Sample description
- Client/program
- Container and preservative
- Analyses required
- Special instructions/notes

Sample containers are also labelled with:

- Date
- Sample description
- Preservatives
- Analyses required
- Client/program

When samples are received at the laboratory, the sample custodian will verify each and every sample against the chain-of-custody forms, note any discrepancies or losses of samples, and then sign for receipt of the samples. Samples will remain under the control of the sample custodian until samples are transferred to

the analysts for processing. Analysts will acknowledge receipt of samples by signing the chain-of-custody forms.

A sample is considered to be in custody if it:

- o Is in the physical possession of the responsible party.
- o Is in view of the responsible party.
- o Is secured by the responsible party to prevent tampering.
- o Is secured by the responsible party in a restricted area.

4.4 <u>Sample Receipt</u>

Samples received at the laboratory are inspected for integrity, and any field documentation is reviewed for accuracy and completeness. If chain-of-custody forms do not accompany the samples, the sample custodian will initiate these forms. When samples are received with missing or deficient chain-of-custody forms, the legal traceability of these samples cannot extend to the time of collection but must begin at the time of laboratory receipt.

Chain-of-custody and sample integrity problems are noted and recorded during sample log-in. The Project Manager is informed of the deficiencies and will advise the laboratory on the desired disposition of the samples. Chain-of-custody forms and deficiency notices are maintained in the client file.

Each sample that is received by the laboratory is assigned a unique sequential WESTON sample number which will identify the sample in the laboratory's internal tracking system.

References to a sample in any communication will include the assigned sample number to specify which sample is of concern.

4.5 <u>Sample Storage</u>

Samples will be stored in a locked refrigerator at 4°C. The temperature of the storage refrigerators will be monitored and recorded daily by the sample custodian. Sample fractions and extracts will also be stored under these same conditions.

4.6 Sample Retention and Disposal

Samples will be retained in the refrigerator for thirty (30) calendar days after the date of the invoice accompanying the analytical results. Unless a written request is received for retaining the sample beyond the thirty (30) days, the samples will be disposed of in an appropriate manner.

5.0 ANALYTICAL SYSTEMS

5.1 Instrument Maintenance

Instruments will be maintained in accordance with manufacturers' specifications. More frequent maintenance may be dictated dependent on operational performance. Instrument logs will be maintained to document the date and type of maintenance performed.

Contracts on major instruments with manufacturers and service agencies are used to provide routine preventive maintenance and to ensure rapid response for emergency repair service. Minimal instrument down-time is experienced through the use of these contracts.

5.2 Instrument Calibration

Before any instrument can be used as a measurement device, the instrumental response to known reference materials must be determined. The manner in which the various instruments are calibrated will be dependent on the particular instrument and the intended use of the instrument. All sample measurements will be made within the calibrated range of the instrument. Preparation of all reference materials used for calibration will be documented in a standards preparation notebook.

Laboratory balances will be calibrated annually and will be checked before and after use on a daily basis. A record of calibrations and daily checks will be kept in the balance log.

Oven thermometers will be calibrated annually against a National Bureau of Standards certified thermometer in the range of interest. Annual calibrations will be recorded in a calibration notebook. Daily readings will be recorded with the respective analysis (e.g., the solids book).

5.3 Personnel Training

Prior to conducting analyses on an independent basis, analysts are trained by experienced personnel in the complete performance

of an analytical method. If instrumentation is particularly complicated, analysts may be trained at instrument manufacturers' training courses. The analyst is then required to independently generate data on several method and/or matrix spikes to demonstrate proficiency in that analytical method. The type of data to be generated will be dependent on the analytical method to be performed. Results of this "certification" are then reviewed by the appropriate supervisor for adequacy.

Since method blanks and method spikes are required routine samples in every lot, performance on a day-to-day basis can be monitored by comparison with the original and cumulative data on similar samples. Supervisors and the laboratory Quality Assurance/Quality Control Coordinator are responsible for ensuring that samples are analyzed by only competent analysts.

5.4 Standard Analytical Methods

General: Analytical methods are routinely conducted as outlined in published sources (EPA, Standard Methods, ASTM, AOAC, etc.). Modifications to these methods may be necessary in order to provide accurate analyses of particularly complex matrices. When modifications to standard analytical methods are performed, the specific alterations as well as the reason for the change will be reported with the results of analyses.

5.4.1 Gas Chromatography/Mass Spectroscopy (GC/MS)

5.4.1.1 GC/MS Instrument Performance Documentation

Mass spectrometers are tuned on a daily basis to manufacturer's specifications with FC-43. In addition, once per shift, these instruments are tuned with decafluorotriphenylphosphine (DFTPP) or 4-bromo-fluorobenzene (BFB) for semi-volatiles or volatiles, respectively. Ion abundances will be within the windows dictated by the specific program requirements. Once an instrument has been tuned, initial calibration curves for analytes (appropriate to the analyses to be performed) are generated for at least five (5) solutions containing known concentrations of authentic standards of compounds of concern. The calibration curve will bracket the anticipated working range of analyses.

Calibration data, to include linearity verification determined by response factor evaluation (RSD <30 percent for compounds named in ensuing section 5.4.1.2 of this operating practice) will be maintained in the laboratory's permanent records of instrument calibrations.

5.4.1.2 GC/MS Method Performance Documentation

During each operating shift, a midpoint calibration standard is analyzed to verify that the instrument responses are still within the initial calibration determinations. The calibration check compounds will be those analytes used in the EPA Contract Laboratory Program's multicomponent analyses (e.g., priority pollutants and hazardous substances list) with the exception that benzene is used in place of vinyl chloride (volatiles) and di-n-octyl phthalate is deleted from the semi-volatile list.

The response factor drift (% D, i.e., percent difference compared to the average response factor from the initial calibration) will be calculated and recorded. If significant (>30%) response factor drift is observed, appropriate corrective actions will be taken to restore confidence in the instrumental measurements.

All GC/MS analyses will include analysis of a method blank, a method blank spike (semi-volatiles and pesticides/PCB's), a matrix spike, and a laboratory duplicate in each lot of twenty (20) or fewer samples. The US EPA-CLP matrix spike solutions will be used for both matrix spikes and blank spikes. In addition, appropriate surrogate compounds specified in EPA methods will be spiked into each sample. Recoveries from method spikes and surrogate compounds are calculated and recorded on control charts to maintain a history of system performance.

A method blank spike duplicate sample may be analyzed in place of the matrix spike for analytical lots of less than ten (10) samples.

Audit samples will be analyzed periodically to compare and verify laboratory performance against standards prepared by outside sources.

5.4.1.3 GC/MS Detection Limits

The US EPA-CLP contract required quantitation limits (CRQL) are used for reporting GC/MS data. These detection limits are compared with laboratory-determined instrument detection limits to ensure that the reported values are attainable. Instrument detection limits are determined from triplicate analysis of target compounds measured at three to five times the CRQL. The calculated instrument detection limit is three times the standard deviation of the measured values.

5.4.2 Gas Chromatography and High Performance Liquid Chromatography (GC and HPLC)

5.4.2.1 GC and HPLC Calibration

Gas chromatographs and high performance liquid chromatographs will be calibrated prior to each day of use. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis.

Working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five (5) concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations (or response) must be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be obtained, additional standards must be analyzed to define the calibration curve. A midpoint calibration check standard will be analyzed each shift to confirm the validity of the initial calibration curve. The check standard must be within twenty (20) percent of the initial response curve to demonstrate that the initial calibration curve is still valid.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

5.4.2.2 GC and HPLC Quality Control

At least one method blank and two method spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately five (5) times the detection limits.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. These recoveries will be plotted on control charts to monitor method accuracy. Precision will be measured by the reproducibility of both method spikes and will be calculated as relative percent difference (% RPD). These % RPD's will be plotted on control charts to monitor method precision.

5.4.2.3 GC and HPLC Detection Limits

The US EPA-CLP contract required quantitation limits (CRQL) are for reporting GC data. These detection limits are compared with laboratory determined instrument detection limits to ensure that the reported values are attainable. Instrument detection limits are determined from triplicate analysis of target compounds measured at three to five times the CRQL. The calculated instrument detection limit is three times the standard deviation of the measured values.

The detection limits for HPLC analyses are reported as equal to the concentration of the lowest calibration standard analyzed on a particular day. The only exception to this for HPLC analyses are analyses conducted according to USATHAMA analytical and Quality Assurance Protocols. In those cases, detection limits are reported in accordance with procedures described in "USATHAMA Quality Assurance Plan," December 1985, Revision 1 (U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD 21010-5401).

5.4.3 Atomic Absorption Spectrophotometry (AA)

5.4.3.1 AA Calibration

Atomic absorption spectrophotometers will be calibrated prior to each day of use.

Calibration standards will be prepared from appropriate reference materials, and working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of three (3) concentrations to cover the anticipated range of measurement.

Duplicate injections will be made for each concentration. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

5.4.3.2 AA Quality Control

At least one method blank and two method blank spikes (laboratory control samples: LCS) will be included in each laboratory lot of samples. Regardless of the matrix being processed, the LCS and blanks will be in aqueous media. The LCS will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory and will be introduced at a frequency of one per analytical lot or five (5) percent of the samples, whichever is more. The LCS will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery (% R) of the spikes. The recovery must be within the range 80-120 percent to be considered acceptable. Additionally, the LCS % R will be plotted on control charts to monitor method performance.

Precision will be measured by the reproducibility of both LCS and will be calculated as relative percent difference (% RPD). Results must agree within twenty (20) percent RPD in order to be considered acceptable.

5.4.3.3 AA Detection Limits

The laboratory routinely reports EPA-CLP Contract Required Quantitation Limits (CRQL's) for client reports. These limits are compared with laboratory-determined Instrument Detection Limits (IDL's) on a quarterly basis to ensure that the reported values are attainable. IDL's are determined from three nonconsecutive day's analysis of seven consecutive measurements of target compounds at three to five times the IDL. Each day's seven measured values are averaged and the respective standard deviation calculated. Three times the standard deviation of the average of the standard deviations obtained from the three days' analysis is defined as the IDL. The IDL's must be at or below the CRQL's.

5.4.4 Inductively Coupled Plasma Spectroscopy (ICP)

5.4.4.1 ICP Calibration

The inductively coupled plasma spectrometer will be calibrated prior to each day of use. Calibration standards will be prepared from reliable reference materials and will contain all metals for which analyses are being conducted. Working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five (5) concentrations to

cover the anticipated range of measurement. Duplicate readings will be made for each concentration. At least one of the calibration standards will be at or below the desired instrumental detection limit. The correlation coefficient of the plot of responses versus concentrations will be at least 0.996 in order to consider the responses linear. If a correlation coefficient of 0.996 cannot be obtained, the spectrometer will be recalibrated prior to analysis of samples. This calibration will be done quarterly to verify the linear range of the instrument.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

On a daily basis, the instrument will be calibrated using a standard at the high end of the calibration range. This standard must not deviate more than ±5 percent from the quarterly established value. The calibration is verified with a mid-range calibration check standard which is prepared from a different source than the instrument calibration standard. This standard must not deviate more than ±10 percent from the target value. In addition, a linear range check at approximately two times the detection limit will be analyzed to verify linearity near the detection limit.

5.4.4.2 ICP Quality Control

At least one method blank and two method blank spikes (laboratory control samples: LCS) will be included in each laboratory lot of samples. Regardless of the matrix being processed, the LCS's and blanks will be in aqueous media. The LCS will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The LCS results will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery (% R) of the spikes. The recovery must be within the range 80-120 percent to be considered acceptable. Additionally, the LCS % R will be plotted on control charts to monitor method accuracy.

Precision will be measured by the reproducibility of both LCS and will be calculated as relative percent difference (% PRD). Results must agree within twenty (20) percent RPD in order to be considered acceptable.

5.4.4.3 ICP Detection Limits

The laboratory routinely reports EPA-CLP Contract Required Quantitation Limits (CRQL's) for client reports. These limits are compared with laboratory-determined Instrument Detection Limits (IDL's) on a quarterly basis to ensure that the reported values are attainable. IDL's are determined from three nonconsecutive day's analysis of seven consecutive measurements of target compounds at three to five times the IDL. Each day's seven measured values are averaged and the respective standard deviation calculated. Three times the standard deviation of the average of the standard deviations obtained from the three days' analysis is defined as the IDL. The IDL's must be at or below the CRQL's.

5.4.5 Total Organic Carbon (TOC)

5.4.5.1 TOC Calibration

The total organic carbon analyzer will be calibrated prior to each day of use.

Calibration standards will be prepared from potassium hydrogen phthalate, and working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five (5) concentrations to cover the anticipated range of measurement.

At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples. Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

5.4.5.2 TOC Quality Control

At least one method blank and two method spikes will be included in each laboratory lot of samples. Method spikes will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory. The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery (% R) of the spikes. The recovery must be within the range 90-110 percent to be considered

acceptable. In addition, % R will be plotted on control charts to monitor method accuracy.

Precision will be measured by the reproducibility of both method spikes and will be calculated as relative percent difference (% RPD). Results must agree within twenty (20) percent RPD in order to be considered acceptable.

2.4.5.3 TOC Detection Limits

The detection limits are based on the concentration of the lowest standard analyzed. Results below the lowest standard are rpeorted as below the detection limit.

5.4.6 Ion Chromatography (IC)

5.4.6.1 IC Calibration

The ion chromatograph will be calibrated prior to each day of use. Calibration standards will be prepared from appropriate reference materials, and working calibration standards for the ions of interest will be prepared fresh daily. The working standards will include a blank and a minimum of five (5) concentrations to cover the anticipated range of measurements. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

5.4.6.2 IC Quality Control

At least one method blank and two method spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery (% R) of the spikes. The recovery must be within the range of

85-115 percent to be considered acceptable. Additionally, % R will be plotted on control charts to monitor method accuracy.

Precision will be measured by the reproducibility of both method spikes and will be calculated as relative percent difference (% RPD). Results must agree within twenty (20) percent RPD in order to be considered acceptable.

5.4.6.3 Ion Chromatography Detection Limits

The detection limits are based on the concentration of the lowest standard analyzed. Results below the lowest standard are reported as below the detection limit.

5.4.7 Spectrophotometric (Colorimetric) Methods

5.4.7.1 Spectrophotometer Calibration

Spectrophotometers will be calibrated prior to each day of use. Calibration standards will be prepared from reference materials appropriate to the analyses being performed, and working calibration standards will be prepared fresh daily. The working standards will include a blank and minimum of five (5) concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to the analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

5.4.7.2 Spectrophotometer Quality Control

At least one method blank and two method spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The method spikes will be examined to determine both precision and accuracy.

Accuracy will be measured by the percent recovery (% R) of the spikes. The recovery must be in the range (90-110 percent) in order to be considered acceptable. Additionally, % R will be plotted on control charts to monitor method accuracy.

Precision will be measured by the reproducibility of both method spikes and will be calculated as relative percent difference (% RPD). Results must agree within twenty (20) percent RPD in order to be considered acceptable.

5.4.7.3 Spectrophotometric Methods Detection Limits

The detection limits are based on the concentration of the lowest standard analyzed. Results below the lowest standard are reported as below the detection limit.

5.5 Methods Development

When standard (published) methods of analyses are not applicable to analyses to be performed, methods can be developed to provide the desired information. However, the lack of a historical data base does not obviate the necessity for documented quality control data to demonstrate the validity of the generated results. Reference material sources must be identified, and proof of compound identity and purity must be available. Instrumental operating parameters as well as calibration data must be documented, and specific procedures (to include sampling, if applicable) must be noted. Quality control samples (method blanks, method spikes, method spike duplicates, matrix spikes, and matrix duplicates) should be analyzed with greater frequency than with standard analytical methods to demonstrate the certainty and uncertainty of generated data. Exact requirements for demonstrating the reliability of developed methods are normally dictated by the specific program.

5.6 Reference Materials

Whenever possible, primary reference materials will be obtained from the National Bureau of Standards (NBS) or the U.S. Environmental Protection Agency (EPA). In the absence of available reference materials from these organizations, other reliable sources will be sought. These reference materials will be used for instrument calibration, quality control spikes, and/or performance evaluations. Secondary reference materials may be used for these functions provided that they are traceable to an NBS standard or have been compared to an NBS standard within the laboratory.

5.7 Reagents

Laboratory reagents will be of a quality to minimize or eliminate background concentrations of the analyte to be measured. Reagents must also not contain other contaminants that will interfere with the analyte of concern.

5.8 Corrective Actions

An analysis or analytical system is considered to be out-of-control when it does not conform to the conditions specified by the method or standard operating procedures which apply. To confirm that an analysis or analytical system is in control, the laboratory routinely performs instrument calibration checks, analysis of method blanks and method blank spikes and compares the results of quality control samples to laboratory control charts or analytical protocol criteria (e.g., U.S. EPA-CLP).

When an analysis or analytical system is determined to be out-of-control, the person who identifies that there is a problem is responsible for documenting the occurrence and notifying his or her supervisor and/or Section Manager.

A Corrective Action Documentation Form (Figure 1) is to be completed for each out-of-control situation. It will be distributed to the Section Manager, QA Coordinator and Project Manager. The analyst, working with his or her supervisor or Section Manager, will attempt to determine the cause of the problem and take appropriate corrective action. Analysis may not resume until the problem has been corrected and it is determined that the analysis is back in control. Demonstration of the restoration of analytical control will normally be accomplished by generating satisfactory calibration and/or quality control sample data. This documentation will be attached to the corrective action documentation form.

6.0 DATA MANAGEMENT

6.1 Data Collection

In addition to the data collected in the field and recorded on the chain-of-custody forms, data describing the processing of samples will be accumulated in the laboratory and recorded in laboratory notebooks. Laboratory notebooks will contain:

- Date of processing
- Sample numbers
- Client (optional)
- Analyses or operation performed

- Calibration data
- Quality control samples included
- Concentrations/dilutions required
- Instrument readings
- Special observations (optional)
- Analysts signature

6.2 Data Reduction

Data reduction is performed by the individual analysts and consists of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction will be dependent on the specific analytical method and the number of discrete operations (extractions, dilutions, and concentrations) involved in obtaining a sample that can be measured.

For those methods utilizing a calibration curve, sample responses will be applied to the linear regression line to obtain an initial raw result which is then factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result is obtained to minimize rounding errors, and results will not normally be expressed in more than two (2) significant figures.

Copies of all raw data and the calculations used to generate the final results will be retained on file to allow reconstruction of the data reduction process at a later date.

6.3 Data Review

System reviews are performed at all levels. The individual analyst constantly reviews the quality of data through calibration checks, quality control sample results, and performance evaluation samples. These reviews are performed prior to submission to the Section Managers or the Analytical Project Manager.

The Section Manager and/or the Analytical Project Manager review data for consistency and reasonableness with other generated data and determine if program requirements have been satisfied. Selected hard copy output of data (chromatograms, spectra, etc.) will be reviewed to ensure that results are interpreted correctly. Unusual or unexpected results will be reviewed, and a resolution will be made as to whether the analysis should be repeated. In addition, the Analytical Project Manager or Section Manager will recalculate selected results to verify the calculation procedure.

The Quality Assurance Officer independently conducts a complete review of selected projects to determine if laboratory and client quality assurance/quality control requirements have been met. Discrepancies will be reported to the appropriate Section Manager and/or Analytical Project Manager for resolution.

The final routine review is performed by the Laboratory Manager prior to reporting the results to the client. Non-routine audits are performed by regulatory agencies and client representatives. The level of detail and the areas of concern during these reviews are dependent on the specific program requirements.

6.4 Data Reporting

Reports will contain final results (uncorrected for blanks and recoveries), methods of analysis, levels of detection, surrogate recovery data, and method blanks data. In addition, special analytical problems, and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) significant figures. Data are normally reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of weight per unit volume (e.g., milligrams per liter). Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per gram).

Reported detection limits will be the concentration in the original matrix corresponding to the low level instrument calibration standard after concentration, dilution, and/or extraction factors are accounted for.

6.5 Data Archiving

The laboratory will maintain on file all of the raw data, laboratory notebooks, and other documentation pertinent to the work on a given project. This file will be maintained for five (5) years from the date of invoice unless a written request is received for an extended retention time.

Data retrieval from archives will be handled in a similar fashion to a request for analysis. Specifically, a written work request to include a quotation must be submitted for retrieval of data.

Client confidentiality will be maintained with retrieved data. Consequently, the laboratory can honor only those requests for data authorized by the original client.

7.0 SUBCONTRACTED ANALYSES

The subcontracting of analytical services does not relieve the laboratory of requirements set forth in this plan. Adherence to the provisions of this plan will be part of the subcontracting agreement, and data generated by the subcontractor laboratory will be reviewed with the same rigor as those analyses performed at WESTON facilities.

Figure 1

Corrective Action Documentation Form

CORRECTIVE ACTION DOCUMENTATION

AUDIT REPORT # ________
PAGE ___ OF ___

DISTRIBUTION:
- ☐ EARL HANSEN
- ☐ DEB WHITE
- ☐ CARTER NULTON
- ☐ J. MICHAEL TAYLOR
- ☐ DIANNE THERRY
- ☐ MONTHLY REPORT FILE

DATE/ORIGINATOR: ________________

PERSON RESPONSIBLE FOR RESPONSE: ________________

DESCRIPTION OF PROBLEM and when identified: ________________

State cause of problem if known or suspected: ________________

SEQUENCE OF CORRECTIVE ACTION: (If no responsible person is identified, bring this form directly to the QA Coordinator)

State date, person, and action planned: ________________

CA Initially Approved By: ________________ Date: ________

Follow-up dates: ________________

Description of follow-up: ________________

Final CA Approved By: ________________ Date: ________

WFW 21-21-006/C-2/86

APPENDIX B

ANALYTICAL METHODS, PARAMETERS, AND LIMITS OF DETECTION

SELFRIDGE ANGB, MICHIGAN

Table B-1

Analytical Methods, Parameters, and Limits of Detection,
IRP Stage 2,
Selfridge ANGB, Michigan

Parameters	Methods		Limits of Detection	
	Water	Soil	Water (ug/L)	Soil (mg/kg)
1. Volatile Organic Compounds (VOCs), Water Only				
1.1 Purgeable Halocarbons	E601	NA		
Bromodichloromethane			0.5	---
Bromoform			1	---
Bromomethane			6	---
Carbon tetrachloride			0.6	---
Chlorobenzene			1.2	---
Chloroethane			3	---
2-Chloroethyl vinyl ether			0.7	---
Chloroform			0.2	---
Chloromethane			0.7	---
Dibromochloromethane			0.5	---
1,2-Dichlorobenzene			0.5	---
1,3-Dichlorobenzene			1	---
1,4-Dichlorobenzene			1	---
Dichlorodifluoromethane			9	---
1,1-Dichloroethane			0.4	---
1,2-Dichloroethane			0.2	---
1,1-Dichloroethene			0.7	---
trans-1,2-Dichloroethene			0.5	---
1,2-Dichloropropane			0.2	---
cis-1,3-Dichloropropene			1	---
trans-1,3-Dichloropropene			2	---
Methylene chloride			2	---
1,1,2,2-Tetrachloroethane			0.2	---
Tetrachloroethene			0.2	---
1,1,1-Trichloroethane			0.2	---
1,1,2-Trichloroethane			0.1	---
Trichloroethene			0.6	---
Trichlorofluoromethane			5	---
Vinyl chloride			0.2	---

Table B-1
(continued)

Parameters	Methods Water	Methods Soil	Limits of Detection Water (ug/L)	Limits of Detection Soil (mg/kg)
1. Volatile Organic Compounds (VOCs), Water Only				
1.2 Purgeable Aromatic Compounds	SW5030/ SW8020	NA		
Benzene			0.7	---
Chlorobenzene			1	---
1,2-Dichlorobenzene			2	---
1,3-Dichlorobenzene			2	---
1,4-Dichlorobenzene			1	---
Ethylbenzene			1	---
Toluene			1	---
Xylenes			2	---
2. Volatile Organic Compounds (VOCs), Soil/Sediment Only	NA	SW5030/ SW8240		
Acetone			---	0.1
Benzene			---	0.1
Bromodichloromethane			---	0.1
Bromoform			---	0.1
Bromomethane			---	0.1
Carbon disulfide			---	0.1
Carbon tetrachloride			---	0.1
Chlorobenzene			---	0.1
Chloroethane			---	0.1
2-Chloroethyl vinyl ether			---	0.1
Chloroform			---	0.1

1911B

Table B-1
(continued)

Parameters	Methods		Limits of Detection	
	Water	Soil	Water (ug/L)	Soil (mg/kg)
2. Volatile Organic Compounds (VOCs), Soil Only	NA	SW5030/ SW8240		
Chloromethane			---	0.1
Dibromochloromethane			---	0.1
1,2-Dichlorobenzene			---	0.1
1,3-Dichlorobenzene			---	0.1
1,4-Dichlorobenzene			---	0.1
1,1-Dichloroethane			---	0.1
1,2-Dichloroethane			---	0.1
1,1-Dichloroethene			---	0.1
trans-1,2-Dichloroethene			---	0.1
1,2-Dichloropropane			---	0.1
cis-1,3-Dichloropropene			---	0.1
trans-1,3-Dichloropropene			---	0.1
Diethyl ether			---	0.1
Ethylbenzene			---	0.1
Methylene chloride			---	0.1
Methyl ethyl ketone (MEK)			---	0.1
Methyl isobutyl ketone (MIBK)			---	0.1
1,1,2,2-Tetrachloroethane			---	0.1
Tetrachloroethene			---	0.1
Toluene			---	0.1
1,1,1-Trichloroethane			---	0.1
1,1,2-Trichloroethane			---	0.1
Trichloroethene			---	0.1
Trichlorofluoromethane			---	0.1
Vinyl chloride			---	0.1
Xylenes (total, all isomers)			---	0.1

WESTON

Table B-1
(continued)

Parameters	Methods: Water	Methods: Soil	Limits of Detection: Water (ug/L)	Limits of Detection: Soil (mg/kg)
3. Extractable Priority Pollutants or Semi-volatile Organic Compounds	625	SW3550/ SW8270[1]		
Acenaphthene			10	0.5
Acenaphthylene			10	0.5
Anthracene			10	0.5
Benzo(a)anthracene			10	0.5
Benzo(b)fluoranthene			10	0.5
Benzo(k)fluoranthene			10	0.5
Benzo(a)pyrene			10	0.5
Benzo(g,h,i)perylene			10	0.5
Benzyl butyl phthalate			10	0.5
4-Bromophenyl phenyl ether			10	0.5
Bis(2-chloroethoxy) methane			10	0.5
Bis(2-chloroethyl) ether			10	0.5
Bis(2-chloroisopropyl) ether			10	0.5
2-Chloronaphthalene			10	0.5
4-Chlorophenyl phenyl ether				
Chrysene			10	0.5
Dibenzo(a,h)anthracene			10	0.5
Di-n-butyl phthalate			10	0.5
1,2-Dichlorobenzene			5	0.5
1,3-Dichlorobenzene			5	0.5
1,4-Dichlorobenzene			5	0.5
3,3'-Dichlorobenzidine			20	0.5
Diethyl phthalate			20	0.5
Dimethyl phthalate			10	0.5
2,4-Dinitrotoluene			10	0.5
2,6-Dinitrotoluene			10	0.5
Di-n-octyl phthalate			10	0.5
Bis(2-ethylhexyl)phthalate			10	0.5
Fluoranthene			10	0.5
Fluorene			10	0.5

Table B-1
(continued)

Parameters	Methods Water	Methods Soil	Limits of Detection Water (ug/L)	Limits of Detection Soil (mg/kg)
3. Extractable Priority Pollutants, or Semi-volatile Organic Compounds	625	SW3550 SW8270[1]		
Hexachlorobenzene			10	0.5
Hexachlorobutadiene			10	0.5
Hexachloroethane			10	0.5
Indeno(1,2,3-c,d)pyrene			10	0.5
Isophorone			10	0.5
Naphthalene			10	0.5
Nitrobenzene			10	0.5
N-Nitroso-di-n-propyl-amine			10	0.5
Phenanthrene			10	0.5
Pyrene			10	0.5
1,2,4-Trichlorobenzene			10	0.5
4-Chloro-3-methylphenol			10	0.5
2-Chlorophenol			10	0.5
2,4-Dichlorophenol			10	0.5
2,4-Dimethylphenol			10	0.5
2,4-Dinitrophenol			50	1.6
2-Methyl-4,6-dinitro-phenol			50	1.6
2-Nitrophenol			10	0.5
4-Nitrophenol			42	0.5
Pentachlorophenol			10	1.6
Phenol			10	0.5
2,4,5-Trichlorophenol			50	1.6
2,4,6-Trichlorophenol			10	0.5

WESTON

Table B-1
(continued)

Parameters		Methods: Water	Methods: Soil	Limits of Detection: Water (mg/L)	Limits of Detection: Soil (mg/kg)
4. Metals					
Aluminum	Al	E200.7	SW3050/SW6010	0.2	20
Antimony	Sb	E200.7	SW3050/SW6010	0.2	20
Arsenic	As	E206.2	SW3050/SW7060	0.005	0.5
Barium	Ba	E200.7	SW3050/SW6010	0.01	2
Beryllium	Be	E200.7	SW3050/SW6010	0.002	0.2
Boron	B	E200.7	SW3050/SW6010	0.1	20
Cadmium	Cd	E200.7	SW3050/SW6010	0.005	2
Calcium	Ca	E200.7	SW3050/SW6010	0.1	5
Chromium	Cr	E200.7	SW3050/SW6010	0.03	4
Cobalt	Co	E200.7	SW3050/SW6010	0.04	4
Copper	Cu	E200.7	SW3050/SW6010	0.03	3
Iron	Fe	E200.7	SW3050/SW6010	0.04	4
Lead	Pb	E239.2	SW3050/SW6010	0.005	20
Magnesium	Mg	E200.7	SW3050/SW6010	0.2	20
Manganese	Mn	E200.7	SW3050/SW6010	0.01	1
Molybdenum	Mo	E200.7	SW3050/SW6010	0.1	20
Nickel	Ni	E200.7	SW3050/SW6010	0.015	5
Potassium[2]	K	E200.7	SW3050/SW6010	---	---
Selenium	Se	E270.2	SW3050/SW7740	0.005	1
Silica		E200.7	SW3050/SW6010	0.3	30
Silver	Ag	E200.7	SW3050/SW6010	0.03	4
Sodium	Na	E200.7	SW3050/SW6010	0.9	90
Thallium	Ti	E200.7	SW3050/SW6010	0.2	20
Vanadium	V	E200.7	SW3050/SW6010	0.04	4
Zinc	Zn	E200.7	SW3050/SW6010	0.01	1
Mercury	Hg	E245.1	SW7471	0.001	0.5
5. EP Toxicity Extraction and Metals Analysis		NA	40 CFR 261.24	Extract Concentration (mg/L)	
Arsenic	As			0.5	---
Barium	Ba			1	---
Cadmium	Cd			1.1	---
Chromium	Cr			0.5	---
Lead	Pb			0.5	---
Mercury	Hg			0.02	---
Selenium	Se			0.1	---
Silver	Ag			0.5	---

WESTON

Table B-1
(continued)

Parameters	Methods: Water	Methods: Soil	Limits of Detection: Water (mg/L)	Limits of Detection: Soil (mg/kg)
6. Common Anions				
Fluoride	E340.2	NA	0.1	NA
Nitrate/Nitrite	E353.1	NA	0.1	NA
Bromide	A429	NA	1	NA
Chloride	A429	NA	2.5	NA
Phosphate	A429	NA	2.5	NA
Sulfate	A429	NA	2.5	NA
7. Petroleum Hydrocarbons	E418.1	SW3550/ E418.1	NA	50
8. Nitrogen, Ammonia	E350.3	NA	0.1	NA
9. Total Organic Carbon	E415.1	NA	1	NA
10. Chemical Oxygen Demand	A508A	NA	5	NA
11. Total Dissolved Solids	E160.1	NA	10	NA
12. Acidity	E305.1	NA	10	NA
13 Soil Moisture Content	ASTM D2216		NA	---

Table B-1
(continued)

Notes: The methods cited are from the following sources:

"A" Methods	Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985)
"E" Methods	Methods for Chemical Analysis of Water and Wastes, EPA Manual, 600/4-79-020 (U.S. EPA, 1983 - with additions)
	Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, 40 CFR 136, Appendix A
	Inductively Coupled Plasma - Atomic Emission Spectrometer Method for Trace Element Analysis of Water and Wastes, 40 CFR 136, Appendix C
"SW" Methods	Test Methods for Evaluating Solid Waste Physical/ Chemical Methods. SW-846. 3rd Edition (U.S. EPA, 1986)

[1]A silica gel cleanup will be used as needed for up to 25 percent of the soil samples and 10 percent of the water samples to achieve improved method sensitivity for the reanalysis of BNAs only.
[2]Limit of Detection to be determined.
[3]Extractions and analysis will be performed according to Method SW8150; the esterification step will be performed according to A509B in order to avoid handling diazomethane.
[4]Second column confirmation required for GC methods whenever any analyte is detected.

WESTON

APPENDIX C

BURMISTER AND UNIFIED SOIL CLASSIFICATION SYSTEMS

PRESENTATION OF IDENTIFICATIONS

BASED ON THE

BURMISTER SYSTEM

Fully Written Descriptions

Start the description with the color, first letter of first color capitalized (e.g. Brown, Yellow brown, Yellow and brown). The color should be the same as field description, since with oxidation the color sometimes changes between the time the sample is recovered and when it is viewed in the laboratory.

Determine the primary component (e.g. sand, gravel, or silt) and whether the component represents 50% (by weight) or more of the sample.

1. If more than 50% sand, the word sand gets fully capitalized. Preceding the word sand, are the terms coarse, medium and/or fine as follows:
   a. If there are approximately equal amounts of coarse, medium and fine sand, the description reads "coarse to fine SAND." If there is

more coarse sand, the description reads "coarse (+) to fine SAND." The same holds true for the fine sand predomination. If medium sand predominates, the description reads "coarse medium (=) to fine SAND." In order for a term coarse, medium or fine to be included in a description, it must represent at least 10% of the sand fraction. For example, if a sample contains 70% sand, the sample must contain at least 7% of coarse sand for the word coarse to be included in the description. The above usage of coarse, medium and fine applies to gravel as well as sand.

Unless advised to the contrary on a specific job, the differentiation between coarse and fine silt shall not be made.

b. A comma <u>always</u> appears immediately after the word sand. Next comes the adjective giving the approximate percentage of soil by weight passing the #200 sieve as follows:

and:	35-50%	some:	20-35%
little:	10-20%	trace:	1-10%

with a (+) sign indicating the upper third of

percentage, a (-) sign indicating the lower third of percentage, and no sign indicating the middle third of percentage. Next comes a description of the soil passing the #200 sieve, based exclusively on plasticity as follows:

PI	Description	Organic
0 - 1%	Silt	(non-plastic)
1 - 5%	Clayey Silt	(Slight P.I.)
5 - 10%	Silt & Clay	(Low P.I.)
10 - 20%	Clay & Silt	(Medium P.I.)
20 - 40%	Silty Clay	(High P.I.)
40% and more	Clay	(Very High P.I.)

If the soil is organic, the term Organic Silt is used instead of the terms listed under "Description" and the terms listed under "Organic" are used at the very end of the full description (in parentheses).

c. A comma is placed immediately after the term describing the soil passing the #200 sieve (e.g.

Silt & Clay). Next the usage of and, some, little or trace (with a (+) or (-) if needed) is used to indicate the percent of gravel, followed by the use of coarse, medium and/or fine to describe the gravel gradation, with the word gravel always using a capital "G".

d. An illustration of description of a soil having more than 50% sand is as follows:

Brown coarse to fine SAND, little Clayey Silt, some (-) medium to fine (+) Gravel.

2. <u>If the major component is less than 50% of the total sample,</u> the description is written exactly as for Item 1 above (with sand coming first), except that in the word sand, only the S is capitalized rather than the full word.

3. <u>If there is more than 50% gravel</u>, the description once more starts with the color, followed by the applicable terms of coarse, medium and fine, followed by the word GRAVEL in all capitals.

a. The adjective giving the percentage of all the soil except gravel is placed after the word gravel, and then a comma (e.g. if there is 62% gravel, a partial description would be "Brown

medium to fine (+) GRAVEL and (-),....") . The sand is then described by coarse, medium and/or fine without its own percent adjective (with only the S in sand being capitalized). A comma is placed immediately after the word Sand, after which the soil passing the #200 sieve is indicated with the adjective for percentage as given in Item 1b above.

b. An example is: Gray medium to fine (+) GRAVEL and (-), coarse to fine Sand, trace Silt.

4. If there is more than 50% passing the #200 sieve, the description once more starts with the color, followed by the #200 description based exclusively on plasticity as follows:

PI	Description	Organic
0 - 1%	SILT	(non-plastic)
1 - 5%	Clayey SILT	(Slight P.I.)
5 - 10%	SILT & CLAY	(Low P.I.)
10 - 20%	CLAY & SILT	(Medium P.I.)
20 - 40%	Silty CLAY	(High P.I.)

40% or more	CLAY	(Very High P.I.)

If the soil is organic, the term Organic SILT is used instead of the terms listed under "Description", and the terms listed under "Organic" are used at the very end of the full description (in parentheses).

a. The description is written as discussed in Section 3, with sand preceding gravel.

b. An example is: Brown Clayey SILT some (+), coarse to find SAND, trace fine Gravel.

c. In the foregoing example, if the fines are organic the identification would be:

   Brown Organic SILT some (+), coarse to fine Sand, trace fine Gravel (Slight P.I.).

5. If pockets, layers, etc., of other soil are present in the sample, include it at the end of the previously written description with a comma at the end of the previously written description.

6. If closely layered (partings, seams, or layers) soils, such as varved clays, are involved, each layer must be

completely identified along with a sketch in the remarks column showing layer thicknesses.

7. Organic soils are identified as Organic Silt (as previously described) or as Peat.

   a. Characteristics of Organic Silt are:

      (1) Usually light gray to very dark gray (or black) color

      (2) Odor caused by decomposition or plant or animal life imparting H_2S, CO_2 and other organic gases

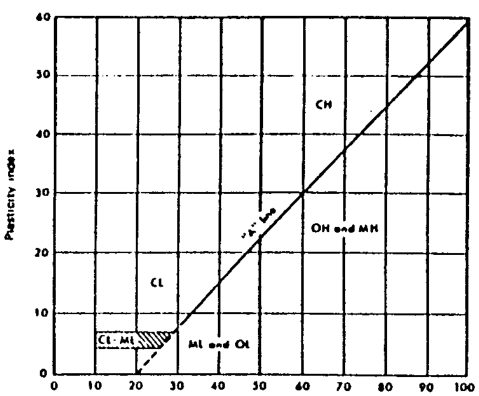
      (3) Plastic properties, usually very compressible

      (4) May contain shells and fragments of partly decayed vegetable matter

   b. Characteristics of Peat are:

      (1) Fibrous aggregate of undecayed or partially decayed vegetable matter, found in swamps

Major Divisions			Group symbols	Typical names	Laboratory classification criteria	
Coarse grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well graded gravels, gravel-sand mixture, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent: GW, GP, SW, SP; More than 12 per cent: GM, GC, SM, SC; 5 to 12 per cent: *Borderline* cases requiring dual symbols**	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4, $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM* (d, u)	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4 — Above "A" line with P.I. between 4 and 7 are *border-line* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6, $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM* (d, u)	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4 — Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. > than 7
Fine grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Plasticity Chart	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
Highly organic soils			Pt	Peat and other highly organic soils		



Plasticity Chart

Material	Particle Size	
	mm	Sieve Size
Silt or Clay	<0.074	-#200
Sand Fine	0.074 To 0.42	#200 To #40
Sand Med.	0.42 To 2.00	#40 To #10
Sand Coarse	2.00 To 4.76	#10 To #4

Material	Particle Size	
	mm	Sieve
Gravel Fine	4.76 To 19.1	#4 To 3/4 in.
Gravel Coarse	19.1 To 76.2	3/4 in To 3 in.
Cobbles	76.2 To 304.8	3 In To 12 in
Boulders	304.8 To 914.4	12 In To 36 in

*Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits, suffix d used when L.L. is 28 or less and the P.I. is 6 or less, the suffix u used when L.L. is greater than 28.

**Borderline classifications used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example GW-GC, well graded gravel-sand mixture with clay binder.

KEY TO SOIL SYMBOLS AND TERMS

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System, as described in Technical Memorandum No. 3-357, Waterways Experiment Station, March 1953.

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve) Includes (1) clean gravels and (2) silty or clayey gravels and sands. Condition is rated according to relative density[1] as determined by laboratory tests or standard penetration resistance tests.

Descriptive Term	Relative Density
Very loose	0 to 15%
Loose	15 to 35%
Medium dense	35 to 65%
Dense	65 to 85%
Very dense	85 to 100%

FINE GRAINED SOILS (major portion passing No. 200 sieve) Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

Descriptive Term	Unconfined Compression Strength, tons/sq. ft.
Very soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very stiff	2.00 to 4.00
Hard	4.00 and higher

TEST AND SAMPLE IDENTIFICATION

- 15 — The number of blows (15) of a 140-pound hammer falling 30 inches used to drive a 2" O. D. split-barrel sampler for the last 12 inches of penetration.
- 50/2 — Number of blows (50) used to drive the split-barrel a certain number of inches (2).
- P — Thin-wall tube sample.
- P/250 — Thin-wall tube pushed hydraulically, using a certain pressure (250 psi) to push the last 6 inches.
- C_t — Denison or Pitcher-Type — core-barrel sample.
- Ps — Piston sample.
- A — Auger sample.
- BX — Rock cored with BX core barrel, which obtains a 1-5/8" diameter core.
- NX — Rock cored with NX core barrel, which obtains a 2-1/8" diameter core.
- 65% — Percentage (65) of rock core recovered.
- 20% — Rock Quality Designation (RQD)[2]
- VS — Vane Shear Test.

Sample Recovered / Sample Not Recovered

Laboratory Test Performed:

- C — Consolidation and specific gravity tests.
- D — Maximum & minimum density.
- DS — Direct Shear test.
- G — Specific gravity test.
- K — Permeability test.
- M — Mechanical (sieve or hydrometer) analysis.
- T — Triaxial compression test.
- U — Unconfined compression test.
- W — Unit weight & natural moisture content.
- X — Special tests performed — see Laboratory test results.

[2] RQD = $\frac{\sum \text{Core Segments} \geq 4 \text{ Inches}}{\text{Core Interval}} \times 100$ Where Segmentation Is Not Caused By Drilling Effects

[1] ASTM 2049-69

APPENDIX D

COMMUNITY RELATIONS PLAN

SELFRIDGE ANGB, MICHIGAN

WESTON

APPENDIX D

Community Relations Plan
Selfridge ANGB, Michigan

Community relations for the Stage 2 study will be handled by the Selfridge ANGB Public Affairs Office. This office advises the Base Commander and other base personnel on matters related to public affairs, provides information about the Air National Guard Base and base activities to the public, and is charged with ensuring the best relations possible between the Air National Guard Base and local communities.

All inquiries concerning IRP activities at the base should be addressed to the Chief of Public Affairs for Selfridge ANGB:

Donald E. Odell
Chief of Public Affairs
Selfridge ANGB, MI 48045
313-466-4735

At all times during the process of the Stage 2 study, the Public Affairs Office (PAO) will have access to the technical data and reports being generated as they become available to theBbase Point-of-Contact (POC) for the project. In addition, the PAO will provide periodic news releases related to key milestones in the study. The PAO will maintain on-file all news releases related to the IRP including earlier releases related to the IRP Phase I and Phase II Stage 1 studies.